

Docket No.: NIH-0127
 Inventor: Mario H. Skiadopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAFLUENZA VIRUS (PIV)
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 Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 35

ACCAAACAAG AGAAGAGACT TGCTTGGAA TATTAATTCA AAAAAAATT AACTTAGGAT 60
 TAAAGAACCTT TACCGAAAGG TAAGGGAAA GAAATCTAA GACTGTAATC ATGTTGAGTC 120
 TATTCGACAC ATTCACTGCG CGTAGGCAGG AGAACATAAC GAAATCAGCT GGTGGGGCTG 180
 TTATTCGGC GCAAAAAAAC ACTGTGTCTA TATTTGCTCT TGGACCATCA ATAACAGATG 240
 ACAATGATAA AATGACATTG GCTCTTCTCT TTTTGCTCTA TTCTTTAGAC AATGAAAAGC 300
 AGCATGCGCA AAGAGCTGGA TTTTTAGTTT CTCTGTTATC AATGGCTTAT GCCAACCCAG 360
 AATTATATTT AACATCAAAT GGTAGTAATG CAGATGTTAA ATATGTTATC TACATGATAG 420
 AGAAAAGACCC AGGAAGACAG AAATATGGTG GGTGGTCGT CAAGACTAGA GAGATGGTT 480
 ATGAAAAGAC AACTGATTGG ATGTTGGGA GTGATCTTGA GTATGATCAA GACAAATGTT 540
 TGCAAAATGG TAGAAGCACT TCTACAATCG AGGATCTTGT TCATACTTTT GGATAATCCAT 600
 CGTGTCTTGG AGCCCTTATA ATCCAAGTTT GGATAATACT TTGTTAAGGCT ATAACCAGTA 660
 TATCAGGATT GAGGAAAGGA TTCTTTACTC GGTTAGAAGC ATTCGACAA GATGGAACAG 720
 TTAAATCCAG TCTAGTGTG AGCGGTGATG CAGTAGAACAA AATTGGATCA ATTATGAGGT 780
 CCCAACAGAG CTTGGTAACA CTCATGGTTG AAACACTGAT AACAATGAAC ACAGGCAGGA 840
 ATGATCTGAC AACAATAGAA AAGAATATAC AGATTGAGG AACTACATC AGAGATGCG 900
 GTCTTGCTTC ATTTTCAAC ACAATCAGAT ATGGCATTGA GACTAGAATG GCAGCTCTAA 960
 CTCTGTCTAC CCTTAGACCG GATATCAACA GACTCAAGGC ACTGATCGAG TTATACTCTAT 1020
 CAAAGGGGCC ACCTGCTCCT TTTATATGCA TTTTGAGAGA TCCCCTGCAT GGTGAGTTG 1080
 CACCAAGCAA CTATCCTGCC CTCTGGAGTT ATGCGATGGG TGTAGCAGTT GTACAAAACA 1140
 AGGCCATGCA ACAGTATGTA ACAGGAAGGT CTTATCTGGA TATTGAAATG TTCCAACCTG 1200
 GTCAAGCAGT GGCACGTGAT GCGAGTCGC AGATGAGTTC AATATTAGAG GATGAACCTGG 1260
 GGGTCACACA AGAAGCCAAG CAAAGCTGAA AGAAACACAT GAAGAACATC AGCAGTCAG 1320
 ATACAACCTT TCATAAGCCT ACAGGGGGAT CAGCCATAGA AATGGCGATA GATGAAGAAG 1380
 CAGGGCAGCC TGAATCCAGA GGAGATCAGG ATCAAGGAGA TGAGCCTCGG TCATCCATAG 1440
 TTCCTTATGC ATGGGCAGAC GAAACGGGA ATGACAATCA AACTGAATCA ACTACAGAAA 1500
 TTGACAGCAT CAAAAGTGA CAAAGAAACA TCAGAGACAG GCTGAACAAA AGACTCAACG 1560
 AGAAAAGGAA ACAGAGTGAC CCGAGATCAA CTGACATCAC AAACAACACA AATCAACACTG 1620
 AAATAGATGA TTGTTCACT GCATTGGAA GCAACTAGTC ACAAGAGAT GACCAACTATC 1680
 ACCAGCAACA AGTAAGAAAA ACTTAGGATT AATGAAATT ATCCAATCCA GAGACGGAAG 1740
 GACAAATCCA GAATCCAACC ACAACTCAAT CAACCAAAGA TTCAATGGAAG ACAATGTTCA 1800
 AAACAATCAA ATCATGGATT CTTGGGAAGA GGGATCAGGA GATAAATCAT CTGACATCTC 1860
 ATCGGCCCTC GACATCATTG AATTCAACT CAGCACCGAC TCCCAAGAAA ACACGGCAGA 1920
 CAGCAATGAA ATCAACACAG GAACCACAAG ACTTAGCACG ACAATCTACC AACCTGAATC 1980
 CAAAACAACA GAAACAAGCA AGGAAAATAG TGGACCAAGCT AACAAAATC GACAGTTGG 2040
 GGCATCACAC GAACGTGCCA CAGAGACAAA AGATAGAAAT GTTAATCAGG AGACTGTACA 2100
 GGGAGGGATAT AGGAGAGGAA GCAGCCCAGA TAGTAGAACT GAGACTATGG TCACTCGAAG 2160
 AATCTCCAGA AGCAGCCCCAG ATCCTAACAA TGGAACCAA ATCCAGGAAG ATATTGATTA 2220
 CAATGAAGTT GGAGAGATGG ATAAGGACTC TACTAAGAGG GAAATGCGAC AATTTAAAGA 2280
 TGTTCCAGTC AAGGTATCAG GAAGTGTGATGC CATTCCCTCCA ACAAAACAAG ATGGAGACGG 2340
 TGATGATGGA 2350

FIGURE 1A



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AGAGGCCCTGG AATCTATCAG TACATTTGAT TCAGGATATA CCAGTATAGT GACTGCCGCA	2410
ACACTAGATG ACGAAGAAGA ACTCCTTATG AAGAACACA GGCCAAGAAA GTATCAATCA	2470
ACACCCCCAGA ACAGTGACAA GGGATTAAA AAAGGGGTTG GAAGGCCAAA AGACACAGAC	2530
AAACAATCAT CAATATTGGA CTACGAACTC AACT TCAAAG GATCGAAGAA GAGCCAGAAA	2590
ATCCTCAAAG CCAGCACGAA TACAGGAGAA CCAACAAAGAC CACAGAATGG ATCCCAGGGG	2650
AAGAGAAATCA CATCCTGGAA CATCCTCAAC AGCGAGAGCG GCAATCGAAC AGAATCAACA	2710
AACCAAACCC ATCAGACATC AACCTCGGGA CAGAACCAACA CAATGGGACC AAGCAGAACAA	2770
ACCTCCGAAC CAAGGATCAA GACACAAAAG ACGGATGGAA AGGAAAGAGA GGACACAGAA	2830
GAGAGCACTC GATTTACAGA AAGGGCGATT ACATTAT TAC AGAATCTTGG TGTAATCCAA	2890
TCTGCAGCAA AATTAGACCT ATACCAAGAC AAGAGAGTTG TGTGTGTGGC GAATGTCCTA	2950
AACAATGCAG ATACTGCATC AAAGATAGAC TTCCTAGCAG GTTGTATGAT AGGAGTGTCA	3010
ATGGATCATG ATACCAAATT AAATCAGATT CAGAACGAGA TATTAAGTTT GAAAACGTAT	3070
CTTAAAAAGA TGGATGAATC ACATAGAAGA CTAATTGAGA ATCAAAAAGA ACAATTATCA	3130
CTGATCACAT CATTAACTC AAATCTAAA ATTATGACAG AGAGAGGAGG GAAGAAGGAC	3190
CAACCAGAAC CTAGCGGGAG GACATCCATG ATCAAGACAA AAGCAAAAGA AGAGAAAATA	3250
AAGAAAGTC GGTGACCC TCTTATGGAA ACACAGGGCA TCGAGAAAAAA CATCCCTGAC	3310
CTCTATAGAT CAATAGAGAA AACACCAGAA AACGACACAC AGATCAAATC AGAAA TAAAC	3370
AGATTGAATG ATGAATCCAA TGCCACTAGA TTGATACCTA GAAGAATAAG CAGTACAATG	3430
AGATCATTAA TAATAATCAT TAACAACAGC AATTATCAT CAAAAGCAAA GCAATCATAAC	3490
ATCAACGAAC TCAAGCTCTG CAAGAGTGAC GAGGAAGTGT CTGAGTTGAT GGACA TGTTC	3550
AATGAGGATG TCAGCTCCC GTAAACCGCC AACCAAGGGT CAACACCAAG AAAACCAATA	3610
GCACAAAACA GCCAATCAGA GACCACCCCA ATACACCAAA CCAATCAACA CATAACAAAG	3670
ATCTCCAGAT CATAAGATGAT TAAGAAAAC TTAGGATGAA AGGACTAATC AATCC TCCGA	3730
AACAATGAGC ATCACCAACT CCACAATCTA CACATTCCA GAATCCTCTT TCTCCGAGAA	3790
TGGCAACATA GAGCCGTTAC CACTCAAGGT CAATGAA CAG AGAAAAGGCCA TACCTCATAT	3850
TAGGGTTGTC AAGATAGGAG ATCCGCCAA ACATGGATCC AGATATCTGG ATGCT TTTT	3910
ACTGGGCTTC TTTGAGATGG AAAGGTCAAAG AGACAGGTAT GGGAGCATAA GTGATCTAGA	3970
TGATGATCCA AGTTACAAGG TTTGTGGCTC TGGATCATG CCACTTGGGT TGGCTAGATA	4030
CACCGGAAAT GATCAGGAAC TCCTACAGGC TGCAACCAAG CTCGATATAG AAGTAAGAAG	4090
AACTGTAAG GCTACGGAGA TGATAGTTA CACTGTACAA AACATCAAAC CTGAACATATA	4150
TCCATGGTCC AGTAGATTAA GAAAAGGGAT GTTATTGAC GCTAATAAGG TTGCACTTGC	4210
TCCTCAATGT CTTCCACTAG ATAGAGGGAT AAAATTCAAG GTGATATTG TGAAC TGCAC	4270
AGCAATTGGA TCAATAACTC TATTCAAAT CCCTAAGTCC ATGGCATTGT TATCA TTGCC	4330
TAATACAATA TCAATAAAATC TACAAGTACA TATCAAAACA GGAGTTCAGA CAGAT TCCAA	4390
AGGAGTAGTT CAGATTCTAG ATGAAAAAGG TGAAAAATCA CTAAATTCA TGGTT CACTT	4450
CGGGTTGATC AAAAGGAAGA TGGGCAGAAT GTACTCAGTT GAATATTGTA AGCAGAAGAT	4510
CGAGAAAGATG AGATTATTAT TCTCATTGGG ATTGTTGGA GGGATCAGCT TCCACGTCAA	4570
CGCAACTGGC TCTATATCAA AGACATTAGC AAGTCAAATTA GCATTCAAAA GAGAAATCTG	4630
CTATCCCTA ATGGATCTGA ATCCACACTT AAATTCAAGTT ATATGGGCAT CATCAGTTGA	4690
AATTACAAGG	4700

FIGURE 1B



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GTAGATGCAG TTCTCCAGCC	4760
GCAAAAGGGG TCGGGAAAAT	4820
ATCAGGCTAC CCACAGGAGA	4880
CGGAAAACAG CCAAACAAAC	4940
AGACCGAGAA AAAACAGAAC	5000
CAAACACACC ACAATCCTG	5060
CAGATATGAC CATCACAAACC	5120
AAATAGACAT AACAAAACTG	5180
AGATTCACA AAATTCGAA ACGAGATACC	5240
ATTCACACTC ATGTGGGGAT	5300
TAATT CCTCT ATATGATGGA	5360
CCCACAACAA TACTAATCTT	5420
CGATAGGGAT AGCCACTTCA	5480
AGGCAAAGTC AGACATAGAA	5540
AATCGATTCA AAGTTCTGTA	5600
TCAACAATGA AATTATACCT	5660
TGGGAATTGC ATTGACACAA	5720
GAACACTGAA AGAAAAAGGG	5780
TAACGGAAAT ATTTACTACT	5840
CTGAGTCAAT CAAGATGAGA	5900
AAGTTAGACT TCCTTTATTA	5960
TATCATACAA CATCCAGGGC	6020
AAGGGGCTTT TCTAGGTGGT	6080
TATGCTTTC TGATCCAGGT	6140
ACATAACACA GTGCTCTAAG	6200
TGAATGGTGG ATTAATTGCA	6260
ATAGAATTAA TCAATCACCT	6320
TAATAGGTAT AAACGGAATG	6380
CATTGATGA CATCATATTA	6440
AACTCAACAA GGCAAAACTA	6500
AAAAGTTAGA TTCCGTTGGA	6560
TGATGATAAT AATTCTAGTT	6620
ATAGAATTCA GGGGAAAGAT	6680
GACAATAAGA CTATACACGA	6740
TCAACACAGC AGCACCGAAT	6800
TGGAATATTG GAAACACACA	6860
GAGGCAAACA TAGTAGCAAG	6920
TAACAAATATT ATCAGTCATT	6980
ATAATAAATT AATGTTGCAG	7040
AGAGGACTTC	7050

FIGURE 1C



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GGATGACATT GGAAACCTCAA TACAGTCAGG AATAAATACA AGACTTCTCA CAATT CAGAG	7110
TCATGTTCAA AACTATATCC CACTATCATT AACACAAACAA ATGTCAGATC TCAGAAAATT	7170
TATCAATGAT CTAACAAATA AAAGAGAACAA TCAAGAAGTG CCAATACAGA GAATGACTCA	7230
TGATAGAGGT ATAGAACCCC TAAATCCAAA CAAGTTCTGG AGGTGTACAT CTGGTAACCC	7290
ATCTCTAACAA AGTAGTCCTA AGATAAGGTT AATACCAGGA CCAGGTTTAT TAGCAACATC	7350
TACTACAGTA AATGGCTGTA TTAGAATTCC ATCGTTAGTA ATCAATCATC TAATCTATGC	7410
TTACACCTCT AATCTTATTAA CCCAGGGCTG TCAAGATATA GGGAAATCTT ACCAAGTACT	7470
ACAAAATAGGG ATAATTACTA TAAATTCGGA CCTAGTACCT GATTTAAACC CCAGAGTCAC	7530
ACATACATTT AATATTGATG ATAATAGAAG ATCTTGCTCT CTGGCACTAT TGAATACAGA	7590
TGTTTATCAG TTATGCTCAA CACCAAAAGT TGATGAAAGA TCCGATTATG CATCAACAGG	7650
TATTGAGGAT ATTGTACTTG ACATTGTCAC TAATAATGGA TTAATTATAA CAACAAGGTT	7710
TACAAATAAT AATATAACTT TTGATAAACCG GTATGCAGCA TTGTATCCAT CAGTGGGACC	7770
AGGAATCTAT TATAAGGATA AAGTTATATT TCTCGGATAT GGAGGTCTAG AGCATGAAGA	7830
AAACGGAGAC GTAATATGTA ATACAACCTGG TTGTCCTGGC AAAACACAGA GAGACTGTAA	7890
TCAGGCTCT TATAGCCCCAT GGTTCTCAA TAGGAGAATG GTAAACTCTA TTATTGTTG	7950
TGATAAAGGC ATAGATGCAA CTTTTAGCTT GAGGGTGTGG ACTATTCCAA TGAGCCAAAA	8010
TTATTGGGGA TCAGAAGGAA GATTACTTT ATTAGGTGAC AGAATATACA TATATACTAG	8070
ATCCACAAGT TGGCACAGTA AATTACAGTT AGGGGTAAATT GATATTCTG ATTATACTAA	8130
TATAAGAATA AATTGGACTT GGCATAATGT ACTATCACGG CCAGGGAAATG ATGAATGTCC	8190
ATGGGGTCAT TCATGCCAG ACGGATGTAT AACAGGAGTT TACACTGATG CATATCCGCT	8250
AAACCCATCG GGGAGTGTG TATCATCAGT AATTCTTGAT TCACAAAAGT CTAGAGAAAA	8310
CCCAATCATT ACTTACTCAA CAGCTACAAA TAGAATAAT GAATTAGCTA TATATAACAG	8370
AACACTTCCA GCTGCATATA CAACAACAAA TTGTATCACAC CATTATGATA AAGGGTATTG	8430
TTTCATATA GTAGAAATAA ATCACAGAAAG TTTGAATACG TTCAACCTA TGTTATTCAA	8490
AACAGAAGTT CCAAAAAACT GCAGCTAAAT TGATCATCGC ATATCGGATG CAAGATGACA	8550
TTAAAAGAGA CCACCCAGACA GACAACACAG GAGACGATGC AAGATATAAA GAAATAATAA	8610
AAAACCTTAGG AGAAAAGTGT GCAAGAAAAA TGGACACCGA GTCCCACAGC GGCAC AACAT	8670
CTGACATTCT GTACCCCTGAA TGTCACCTCA ATTCTCTAT AGTTAAAGGA AAGATAGCAC	8730
AACTGCATAC AATAATGAGT TTGCCTCAGC CCTACGATAT GGATGATGAT TCAATACTGA	8790
TTATTACTAG ACAAAAAATT AAACTCAATA AATTAGATAA AAGACAACGG TCAAT TAGGA	8850
AATTAAGATC AGTCTTAATG GAAAGAGTAA GTGATCTAGG TAAATATACC TTTATCAGAT	8910
ATCCAGAGAT GTCTAGTGAA ATGTTCAAAT TATGTATACC CGGAATTAAT AATAAAATAA	8970
ATGAATTGCT AAGTAAAGCA AGTAAACAT ATAATCAAAT GACTGATGGA TTAAGAGATC	9030
TATGGGTTAC TATACTATCG AAGTTAGCAT CGAAAAATGA TGGAAGTAAT TATGATATCA	9090
ATGAAGATAT TAGCAATATA TCAAATGTTAC ACATGAC TTA TCAATCAGAC AAATGGTATA	9150
ATCCATTCAA GACATGGTT ACTATTAAGT ATGACATGAG AAGATTACAA AAAGCCAAAA	9210
ATGAGATTAC ATTCAATAGG CATAAAAGATT ATAATCTATT AGAAGACCAA AAGAA TATAT	9270
TGCTGATACA TCCAGAACTC GTCTTAATAT TAGATAACAA AAATTACAAAT GGGTATATAA	9330
TGACTCCTGA ATTGGTACTA ATGTATTGTG ATGTAGTTGA AGGGAGGTGG AATATAAGTT	9390
CATGTGCAAA	9400

FIGURE 1D



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ATTGGATCCT AAGTTACAAT CAATGTATTA TAAGGGTAAAC AATTTATGGG AAATAATAGA	9460
TGGACTATTC TCGACCTTAG GAGAAAGAAC ATTTGACATA ATATCACTAT TAGAACCACT	9520
TGCATTATCG CTCATTCAA CTTATGACCC GGTTAAAAG CTCAGGGGGG CTTTTTAA	9580
TCACGTGTTA TCAGAAATGG AATTAATATT TGCAGCTGAG TGTACAACAG AGGAAATACC	9640
TAATGTGGAT TATATAGATA AAATTTAGA TGTGTTCAA GAATCACAA TAGATGAAAT	9700
AGCAGAAATT TTCTCTTCT TCCGAACCTT TGGACACCT CCATTAGAGG CGAGTATAGC	9760
AGCAGAGAAA GTTAGAAAGT ATATGTATAC TGAGAAA TGC TTGAAATTTG ATACTATCAA	9820
TAAAATGTCAT GCTATTTTT GTACAATAAT TATAAATGGA TATAGAGAAA GACATGGTGG	9880
TCAATGGCCT CCAGTTACAT TACCTGTCCA TGCACAT GAA TTTATCATAA ATGCA TACGG	9940
ATCAAATTCT GCCATATCAT ATGAGAATGC TGTAGAT TAT TATAAGAGCT TCATAGGAAT	10000
AAAAATTGAC AAGTTATAG AGCCTCAATT GGATGAA GAC TTAACATATTT ATATGAAAGA	10060
TAAAGCATT TCCCCAAAGA AATCAAACGT GGACACAGTC TATCCAGCTT CAAACCTGTT	10120
ATACCGCACT AATGTGTCTC ATGATTACAG AAGATTGTT GAAGTATTTA TAGCAGATAG	10180
TAAAATTTGAT CCCCACCAAG TATTAGATTA CGTAGAA TCA GGATATTGGC TGGATGATCC	10240
TGAATTTAAT ATCTCATATA GTTTAAAGA GAAAGAAATA AAACAAAGAAG GTAGACTTTT	10300
TGCAAAATG ACATACAAGA TGAGGGCTAC ACAAGTA TTA TCAGAAACAT TATTGGCAA	10360
TAATATAGGG AAATTCTTCC AAGAGAATGG GATGGTAAA GGAGAAATTG AATTACTCAA	10420
GAGACTAAC ACAAATATCTA TGTCTGGAGT TCCGCGGTAT AATGAGGTAT ACAATAATTC	10480
AAAAAGTCAC ACAGAAGAAC TTCAGCTTA TAATGCAATT AGCAGTTCCA ATTTATCTTC	10540
TAATCAGAAG TCAAAGAAGT TTGAATTAA ATCTACAGAT ATATACAATG ATGGATACGA	10600
AACCGTAAGC TGCTTCTTAA CGACAGATCT TAAAAAA TAT TGTTAAATT GGAGGTATGA	10660
ATCAACAGCT TTATTCGGTG ATACTTG TAA TCAGATATTT GGGTTAAAGG AATTATTTAA	10720
TTGGCTGCAC CCTCGCCCTG AAAAGAGTAC AATATATGTT GGAGATCCTT ATTGCCCGCC	10780
ATCAGATATT GAACATTTAC CACTTGATGA CCATCCTGAT TCAGGATTTT ATGTT CATAA	10840
TCCTAAAGGA GGAATAGAAG GGTTTGCCA AAAGTTATGG ACACTCATAT CTATCAGTGC	10900
AATAACATTA GCAGCTGTCA AAATCGGTGT AAGAGTT ACT GCAATGGTTC AAGGGATAA	10960
TCAAGCCATA GCTGTTACCA CAAGAGTACC TAATAAT TAT GATTATAAG TTAAGAAAGA	11020
GATTGTTAT AAAGATGTGG TAAGATTTTG TGATTCC TTG AGAGAGGTGA TGGATGATCT	11080
GGGTCATGAG CTCAAACCTAA ATGAAACATAT AATAAGTAGT AAAA TGTTTA TATATAGCAA	11140
AAGGATATAC TATGACGGAA GAATCCTTCC TCAGGCATTA AAAGCATTGT CTAGATGTGT	11200
TTTTGGTCT GAAACAATCA TAGATGAGAC AAGATCAGCA TCCTCAAATC TGGCTACATC	11260
GTTTGCAAAG GCCATTGAGA ATGGCTACTC ACCTGTATTG GGATATGTAT GCTCAATCTT	11320
CAAAATATC CAACAGTTGT ATATAGCGCT TGGAATGAAT ATAAACCCAA CTATAACCCAA	11380
AAATATTTAA GATCAATATT TCAGGAATAT TCATTGGATG CAATATGCCT CCTTAATCCC	11440
TGCTAGTGTGTC GGAGGGATTTA ATTATATGGC CATGTCAAGG TGTTTGTC GAAACATTGG	11500
AGATCCTACA GTCGCTGCGT TAGCCGATAT TAAAAGATTT ATAAAGCAA ATTTGTTAGA	11560
TCGAGGTGTC CTTTACAGAA TTATGAATCA AGAACCAAGGC GAGTCTTCTT TTTTAGACTG	11620
GGCCTCAGAT CCCTATTACAT GTAACTTACCA ACAATCTCAA AATATAACCA CCATGATAAA	11680
GAATATAACT GCAAGAAATG TACTACAGGA CTCACCAAAAC CCATTACTAT CTGGATTATT	11740
TACAAGTACA	11750

FIGURE 1E

O I P E
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ATGATAGAAG AGGATGAGGA ATTAGCTGAG TTCTTAATGG ACAGGAGAAAT AATCC TCCC	11810
AGAGTTGCAC ATGACATTT AGATAATTCT CTTACTGGAA TTAGGAATGC TATAGCTGGT	11870
ATGTTGGATA CAACAAAATC ACTAATTGCA GTAGGGATAA GCAGAGGAGG ATTAACCTAT	11930
AACTTATTAA GAAAGATAAG CAACTATGAT CTTGTACAAT ATGAGACACT TAGTAAAAC	11990
TTAAGACTAA TAGTCAGTGA CAAGATTAAG TATGAAGATA TGTGCTCAGT AGACCTAGCC	12050
ATATCATTAA GACAAAAAAAT GTGGATGCAT TTATCAGGAG GAAGAATGAT AAATGGACTT	12110
GAAACTCCAG ATCCTTTAGA GTTACTGTCT GGAGTAATAA TAACAGGATC TGAACATTGT	12170
AGGATATGTT ATTCAACTGA AGGTGAAAGC CCATATACAT GGATGTATT ACCAGGCAAT	12230
CTTAATATAG GATCAGCTGA GACAGGAATA GCATCAT TAA GGGTCCCTTA CTTTGATCA	12290
GTTACAGATG AGAGATCTGA AGCACAAATAA GGGTATAATCA AAAATCTAAC CAAACAGCT	12350
AAGGCTGCTA TAAGAATAGC AATGATATAT ACTTGGGCAT TTGGGAATGA CGAAATATCT	12410
TGGATGGAAG CATCACAGA T TGCAACAAACA CGTGCAAAC TTACATTGGA TAGCT TAAAG	12470
ATTTGACAC CAGTGACAC ATCAACAAAT CTATCACACA GTTAAAAGA TACTGCTACT	12530
CAGATGAAAT TTTCTAGTAC ATCACTTATT AGAGTAAGCA GGTCATCAC AATATCTAAT	12590
GATAATATGT CTATTAAAGA AGCAAATGAA ACTAAAGATA CAAATCTTAT TTATCAAAG	12650
GTAATGTTAA CAGGATTAAG TGTATTTGAA TATCTAT TTA GGTTAGAGGA GAGTACAGGA	12710
CATAACCTA TGGTCATGCA TCTACATATA GAGGATGGAT GTTGTATAAA AGAGAGTTAC	12770
AATGATGAGC ATATCAATCC GGAGTCTACA TTAGAGTTAA TCAAATACCC TGAGAGTAAT	12830
GAATTTATAT ATGATAAGGA CCCTTAAAG GATATAGATC TATCAAATT AATGGTTATA	12890
AGAGATCATT CTTATACAAT TGACATGAAT TACTGGGATG ACACAGATAT TGTACATGCA	12950
ATATCAATAT GTACTGCAGT TACAATAGCA GATACAATGT CGCAGCTAGA TCGGGATAAT	13010
CTTAAGGAGC TGGTTGTGAT TGCAAATGAT GATGATATTACAGTCTGAT AACTGAA TTT	13070
CTGACCCCTAG ATATACTAGT GTTCTCAAA ACATTTGGAG GGTTACTCGT GAATCAATT	13130
GCATATACCC TTTATGGATT GAAAATAGAA GGAAGGGATC CCATTTGGGA TTATAATG	13190
AGAACATTAA AAGACACCTC ACATTCAGTA CTTAAAGTAT TATCTAATGC ACTATCTCAT	13250
CCAAAAGTGT TTAAGAGAT T TTGGGATTGT GGAGTTT TGA ATCCTATTAA TGGTCTTAAT	13310
ACTGCTAGTC AAGATCAAGT TAAGCTTGCT CTCTCGATTT GCGAGTACTC CTTGGATCTA	13370
TTTATGAGAG AATGGTTGAA TGGAGCATCA CTTGAGATCT ATATCTGTGA TAGTGACATG	13430
GAAATAGCAA ATGACAGAAAG ACAAGCATT CTCTCAAGAC ATCTTGCTT TGTGTGTTGT	13490
TTAGCAGAGA TAGCATCTT TGGACCAAAT TTATTAATC TAACATATCT AGAGAGACTT	13550
GATGAATTAA AACAAACTAT AGATCTGAAC ATCAAAGAAG ATCCTACTCT TAAATATGTG	13610
CAAGTATCAG GACTGTTAA TAAATCATTC CCCTCAACTG TTACGTATGT AAGGAAAAC	13670
GCGATTAAGT ATCTGAGGAT TCGTGGTATT AATCCGCCTG AAACGATTGA AGATTGGGAT	13730
CCCATAGAAG ATGAGAAATA CTTAGACAAT ATTGTTAAA CTGAAATGAA CAATTGCAGT	13790
GATAATCAAAGAGAAATAA AAGTAGTTAT TTCTGGGAT TAGCTCTAAA GAATTATCAA	13850
GTCGTAAAAA TAAGATCCAT AACGAGTGAT TCTGAAGTTA ATGAAGCTTC GAATGTTACT	13910
ACACATGGAA TGACACTTC TCAGGGAGGA AGTTATCTAT CACATCAGCT GAGGTATTT	13970
GGAGTAAACAGTACAAGTT CTTAAAGCT CTTGAATTAT CACAAATCTT AATGAGGGAA	14030
GTTAAAAAAAG ATAAAGATAG ACTCTTTTA GGAGAAGGAG CAGGAGCTAT GTTAGCATGT	14090
TATGATGCTA	14100

FIGURE 1F

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CACTCGGTCC TGCAATAAAAT TATTATAATT CTGGTTTAAA TATTACAGAT GTAAT TGGTC	14160
AACGGGAATT AAAAATCTTC CCATCAGAAG TATCATTAGT AGGTAaaaaaa CTAGGAAATG	14220
TAACACAGAT TCTTAATCGG GTGAGGGGTGT TATTTAATGG GAATCCCAAT TCAACATGGA	14280
TAGGAAATAT GGAATGTGAG AGTTAATAT GGAGTGAATT AAATGATAAG TCAATTGGTT	14340
TAGTACATTG TGACATGGAG GGAGCGATAG GCAAATCAGA AGAAACTGTT CTACA TGAAC	14400
ATTATAGTAT TATTAGGATT ACATATTAA TCGGGGATGA TGATGTTGTC CTAGTATCAA	14460
AAATTATACC AACTATTACT CCGAATTGGT CTAAAATACT CTATCTATAC AAGTTGTATT	14520
GGAAGGATGT AAGTGTAGTG TCCCCTAAAAA CATCCAA TCC TGCCCTAACAA GAGCTTTATT	14580
TAATTTCAAA AGATGCTTAC TGTACTGTAA TGGAACCCAG TAATCTTGT TTATCAAAAC	14640
TTAAAAGGAT ATCATCAATA GAAGAAAATA ATCTATTAAA GTGGATAATC TTATCAAAAAA	14700
GGAAGAATAA CGAGTGGTTA CAGCATGAAA TCAAAGAAGG AGAAAGGGAT TATGGGATAAA	14760
TGAGGCCATA TCATACAGCA CTGCAAATTT TTGGATTCCA AATTAACCTTA AATCACTTAG	14820
CTAGAGAATT TTTATCAACT CCTGATTAA CCAACAT TAA TAATATAATT CAAAGTTTTA	14880
CAAGAACAAAT TAAAGATGTT ATGTTCGAAT GGGTCAA TAT CACTCATGAC AATAAAAGAC	14940
ATAAATTAGG AGGAAGATAT AATCTATTCC CGCTTAAAAAA TAAGGGAAA TTAAGATTAT	15000
TATCACGAAG ATTAGTACTA AGCTGGATAT CATTATCCTT ATCAACCGA TTACTGACGG	15060
GCCGTTTCC AGATGAAAAAA TTGAAAATA GGGCACAGAC CGGATATGTA TCATT GGCTG	15120
ATATTGATT AGAATCCTTA AAGTTATTAT CAAGAAATAT TGTCAAAAT TACAAAGAAC	15180
ACATAGGATT AATATCATAc TGTTTTTGA CCAAAGAGGT CAAAAACTA ATGAA GCTTA	15240
TAGGAGGAGT CAAACTACTA GGAATTCCCTA AACAGTACAA AGAGTTAGAG GATCGATCAT	15300
CTCAGGGTTA TGAATATGAT AATGAATTTG ATATTGATTA ATACATAAAA ACATAAAATA	15360
AAACACCTAT TCCTCACCCCA TTCACCTCCA ACAAAATGAA AAGTAAGAAA AACATGTAAT	15420
ATATATATAC CAAACAGAGT TTTCTCTTG TTTGGT	15456

FIGURE 1G



Docket No.: NIH-0127
 Inventor: Mario H. Skiadopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAINFLUENZA VIRUS (PIV)
 VACCINES Page 8 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 36

ACCAAACAAG AGAAGAGACT TGCTGGGAA TATTAATTCA AAAAAAATT AACTTAGGAT	60
TAAAGAACTT TACCGAAAGG TAAGGGAAA GAAATCTAA GACTGTAATC ATGTTGAGTC	120
TATTCGACAC ATTCAGTGCG CGTAGGCAGG AGAACATAAC GAAATCAGCT GGTGGGGCTG	180
TTATTCGGG GCACACAC ACTGTGTCTA TATTTGCTCT TGACCACATCA ATAACAGATG	240
ACAATGATAA AATGACATTG GCTCTCTCT TTTTGTCTCA TTCTTTAGAC AATGA AAAGC	300
AGCATGCGCA AAGAGCTGGA TTTTTAGTT CTCTGTTATC AATGGCTTAT GCCAA CCCAG	360
AATTATATT AACATCAAAT GGTAGTAATG CAGATGTTAA ATATGTTATC TACATGATAG	420
AGAAAAGACCC AGGAAGACAG AAATATGGTG GGTTTGT CGT CAAGACTAGA GAGATGGTT	480
ATGAAAAGAC AACTGATTGG ATGTTGGGA GTGATCTTGA GTATGATCAA GACAA TATGT	540
TGCAAAATGG TAGAAGCACT TCTACAAATCG AGGATCTTGT TCATACTTT GGATA TCCAT	600
CGTGTCTTGG AGCCCTTATA ATCCAAGTTT GGATAAACT TGTTAAGGCT ATAACCAGTA	660
TATCAGGATT GAGGAAAGGA TTCTTTACTC GGTTAGAAAGC ATTTGACAA GATGGA AACAG	720
TTAAATCCAG TCTAGTGTG AGCGGTGATG CAGTAGAACAA ATTGGATCA ATTATGAGGT	780
CCCAACAGAG CTTGGTAACA CTCATGGTTG AAACACTGAT AACAAATGAAC ACAGG CAGGA	840
ATGATCTGAC AACAAATAGAA AAGAAATATAC AGATTGTAAGG AACTACATC AGAGA TGCAG	900
GTCTTGCTTC ATTTTCAAC ACAATCAGAT ATGGCAT TGA GACTAGAATG GCAGCTCTAA	960
CTCTGTCTAC CCTTAGACCG GATATCAACA GACTCAAGGC ACTGATCGAG TTATA TCTAT	1020
CAAAGGGGCC AC GTGCTCCT TTTATATGCA TTTTGAGAGA TCCC GTGCAT GGTGAGTTTG	1080
CACCAAGGCAA CTATCCTGCC CTCTGGAGTT ATGCCATGGG TGAGCAGTT GTACAAAACA	1140
AGGCCATGCA ACAGTATGTA ACAGGAAGGT CTTATCTGGA TATTGAAATG TTCCAACCTG	1200
GTCAAGCAGT GGCACGTGAT GCCGAGTCGC AGATGAGTTC AATATTAGAG GATGAACCTGG	1260
GGGTCACACACA AGAAGCCAAG CAAAGCTTGA AGAAACACAT GAAGAACATC AGCAG TTCAG	1320
ATACAACCTT TCATAAGCCT ACAGGGGGAT CAGCCATAGA AATGGCGATA GATGAAGAAG	1380
CAGGGCAGCC TGAATCCAGA GGAGATCAGG ATCAAGGAGA TGAGCCTCGG TCATCCATAG	1440
TTCCCTATGC ATGGGCAGAC GAAACCGGGAA ATGACAATCA AACTGAATCA ACTACAGAAA	1500
TTGACAGCAT CAAAAGTGAA CAAAGAAACA TCAGAGACAG GCTGAACAAA AGACTCAACG	1560
AGAAAAGGAA ACAGAGTGAC CCGAGATCAA CTGACATCAC AAACAACACA AATCAAACATG	1620
AAATAGATGA TTGTTTCAGT GCATTCGAA GCAACTAGTC ACAAAAGAGAT GACCACTATC	1680
ACCAGCAACA AGTAAGAAAA ACTTAGGATT AATGGAAATT ATCCAATCCA GAGACGGAAG	1740
GACAAATCCA GAATCCAACC ACAACTCAAT CAACCAAAGA TTCATGGAAG ACAATGTTCA	1800
AAACAAATCAA ATCATGGATT CTTGGGAAGA GGGATCAGGA GATAATCAT CTGACATCTC	1860
ATCGGCCCTC GACATCATTG AATTCTACT CAGCACCGAC TCCCAAAGAA ACACGGCAGA	1920
CAGCAATGAA ATCAACACAG GAACCACAAG ACTTAGCACG ACAATCTACC AACCTGAATC	1980
CAAAACAAACA GAAACAAGCA AGGAAAATAG TGGACCAGCT ACAAAATC GACAGTTGG	2040
GGCATCACAC GAACGTGCCA CAGAGACAAA AGATAGAAAT GTTAATCAGG AGACTGTACA	2100
GGGAGGATAT AGGAGAGGAA GCAGCCAGA TAGTAGAACT GAGACTATGG TCACT CGAAG	2160
AATCTCCAGA AGCAGCCCAG ATCCTAACAA TGGAACCAA ATCCAGGAAG ATATTGATTA	2220
CAATGAAGTT GGAGAGATGG ATAAGGACTC TACTAAGAGG GAAATGCGAC AATTTAAAGA	2280
TGTTCCAGTC AAGGTATCAG GAAGTGATGC CATTCCCTCCA ACAAAACAAG ATGGAGACGG	2340
TGATGATGGA	2350

FIGURE 2A

Docket No.: NIH-0127
 Inventor: Mario H. Skiadopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAFLUENZA VIRUS (PIV)
 VACCINES Page 9 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001



SEQ ID NO: 36

AGAGGCCTGG AATCTATCAG TACATTGAT TCAGGATATA CCAGTATAGT GACTGCCGCA	2410
ACACTAGATG ACGAAGAAGA ACTCCTTATG AAGAACACA GGCAAGAAA GTATCAATCA	2470
ACACCCAGA ACAGTGACAA GGGATTAAA AAAGGGG TTG GAAGGCCAAA AGACACAGAC	2530
AAACAATCAT CAATATTGGA CTACGAACTC AACTCAAAG GATCGAAGAA GAGCCAGAAA	2590
ATCCTCAAAG CCAGCACGAA TACAGGAGAA CCAACAA GAC CACAGAATGG ATCCCAGGGG	2650
AAGAGAATCA CATCCTGGAA CATCCTCAAC AGCGAGAGCG GCAATCGAAC AGAATCAACA	2710
AACCAAACCC ATCAGACATC AACCTCGGGA CAGAACCA ACA CAATGGGACC AAGCAAAACA	2770
ACCTCCGAAC CAAGGATCAA GACACAAAAG ACGGATGGAA AGGAAAGAGA GGACACAGAA	2830
GAGAGCACTC GATTTACAGA AAGGGGATT ACATTAT TAC AGAATCTTGG TGTAATCCAA	2890
TCTGCAGCAA AATTAGACCT ATACCAAGAC AAGAGAG TTG TGTGTGTGGC GAATGTCCTA	2950
AACAATGCG ATACTGCATC AAAGATAGAC T TCCTAGCGAG GTTGTGAT AGGAGTGTCA	3010
ATGGATCATG ATACCAAATT AAATCAGATT CAGAACGAGA TATTAAGTTT GAAAATGAT	3070
CTTAAAAGA TGGATGAATC ACATAGAAGA CTAATTGAGA ATCAAAAAGA ACAAT TATCA	3130
CTGATCACAT CATTAACTC AAATCTTAAATTATGACAG AGAGAGGAGG GAAGAAGGAC	3190
CAACCAAGAAC CTAGCGGGAG GACATCCATG ATCAAGAACAA AAGCAAAAGA AGAGAAAATA	3250
AAGAAAGTCA GGTTTGACCC TCTTATGGAA ACACAGG GCA TCGAGAAAAA CATCCCTGAC	3310
CTCTATAGAT CAATAGAGAA AACACCAGAA AACGACACAC AGATCAAATC AGAAA TAAAC	3370
AGATTGAATG ATGAATCCAA TGCCACTAGA T TAGTACCTA GAAGAATAAG CAGTACAATG	3430
AGATCATTAA TAATAATCAT TAACACAGC AATTATCAT CAAAAGCAA GCAAT CATAAC	3490
ATCAACGAAC TCAAGCTCTG CAAGAGTGAC GAGGAAG TGT CTGAGTTGAT GGACA TGTTC	3550
ATGAGGATG TCAGCTCCCA GTAAACCGCC AACCAAGGGT CAACACCAAG AAAACCAATA	3610
GCACAAAACA GCCAATCAGA GACCACCCCA ATACACC AAA CCAATCAACA CATAACAAAG	3670
ATCTCCAGAT CATAGATGAT TAAGAAAAAC TTAGGATGAA AGGACTAATC AATCC TCCGA	3730
AACAATGAGC ATCACCAACT CCACAATCTA CACATTCCCA GAATCCCTT TCTCCGAGAA	3790
TGGCAACATA GAGCGTTAC CACTCAAGGT CAATGAACAG AGAAAGGCCA TACCTCATAT	3850
TAGGGTTGTC AAGATAGGAG ATCCGCCAA ACATGGATCC AGATATCTGG ATGTC TTTTT	3910
ACTGGGCTTC TTTGAGATGG AAAGGTCAAAGAGACAGG TAT GGGAGCATAA GTGATCTAGA	3970
TGATGATCCA AGTTACAAGG TTTGTGGCTC TGGATCATG CCACTGGGT TGGCTAGATA	4030
CACCGGAAAT GATCAGGAAC TCCTACAGGC TGCAACCAAG CTCGATATAG AAGTAAGAAG	4090
AACTGTAAAG GCTACGGAGA TGATAGTTA CACTGTACAA AACATCAAAC CTGAAC TATA	4150
TCCATGGTCC AGTAGATTAA GAAAAGGGAT GTTATTTGAC GCTAATAAGG TTGCACTTGC	4210
TCCTCAATGT CTTCCACTAG ATAGAGGGAT AAAATTCAAG GTGATATTG TGAAC TGCAC	4270
AGCAATTGGA TCAATAACTC TATTCAAAT CCTAAGTCC ATGGCATTGT TATCA TTGCC	4330
TAATACAATA TCAATAAAATC TACAAGTACA TATCAAACCA GGAGTTCAGA CAGAT TCCAA	4390
AGGAGTAGTT CAGATTCTAG ATGAAAAAGG TGAAAAATCA CTAATTCA TGGTTCATCT	4450
CGGGTTGATC AAAAGGAAGA TGGCAGAAT GTACTCAGTT GAATATTGTA AGCAGAAGAT	4510
CGAGAAGATG AGATTATTAT TCTCATTGGG ATTGTTGGA GGGATCAGCT TCCAC GTCAA	4570
CGCAACTGGC TCTATATCAA AGACATTAGC AAGTCAA TTA GCATTCAAAA GAGAAATCTG	4630
CTATCCCCTA ATGGATCTGA ATCCACACTT AAATTCAAGTT ATATGGCAT CATCAGTTGA	4690
AATTACAAGG	4700

FIGURE 2B

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Docket No.: NIH-0127
 Inventor: Mario H. Skiadopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAINFLUENZA VIRUS (PIV)
 VACCINES Page 10 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 36

GTAGATGCAG TTCTCCAGCC TTCATTACCT GGCGAAT TCA GATACTACCC AAACA TCATA	4760
GCAAAAGGGG TCGGGAAAAT CAGACAGTAA AATCAAC AAC CCTGATATCC AACAT TGCAA	4820
ATCAGGCTAC CCACAGGAGA AAAATCAAA ACTTAGGATC AAAGGGATCA CCACGAACCC	4880
CGGAAAACAG CCAAACAAAC CAACACACAA ATCA CAGACA AAAAGGAGAA GG CACTGCAA	4940
AGACCGAGAA AAAACAGAAC GCACACAACC AAGCAGAGA AAGCCAAAGC CCGCCATTCA	5000
CAAACACACC AACAAATCCTG CAAACAAGCA CCAAACAGA GGTCAAAAGA CAAAG AGCAC	5060
CAGATATGAC CATCACAACC ACAATCATAG CCATATTACT AATACCCCCA TCATT TTGTC	5120
AAATAGACAT AACAAAATG CAACGTGTAG GTGTGTTAGT CAACAATCCT AAAGG CATGA	5180
AGATTCACA AAATTCGAA ACGAGATACC TGATATTAAAG TTTGATAACCC AAAAT AGAGA	5240
ATTCACACTC ATGTGGGAT CAACAGATAA ACCAATACAA GAAGTTATTG GATAG ATTGA	5300
TAATTCCCTCT ATATGATGGA TTAAAATTAC AAAAGATGT AATAGTAGTA AGTCATGAAA	5360
CCCACAACAA TACTAATCTT AGGACAAAAC GATTCTT TGG AGAGATAATT GGGAC AATTG	5420
CGATAGGGAT AGCCACTTCA GCACAAATCA CCGCAGCAGT CGCTCTT GTC GAAGCTAAAC	5480
AGGCAAAGTC AGACATAGAA AAACCTCAAAG AGGCTATAAG AGACACAAAC AAGGCAGTAC	5540
AATCGATTCA AAGTTCTGTA GGTAACCTAA TTGTTGAGT TAAATCAGTT CAAGACTATG	5600
TCAACAATGA ATTATACCT TCAATCACAA GATTAGGCTG TGAAGCAGCA GGGTT ACAAT	5660
TGGGAATTGC ATTGACACAA CATTACTCG AATTAACAAA TATATTTGGT GATAA TATAG	5720
GAACACTGAA AGAAAAAGGG ATAAAATTAC AAGGGATAGC ATCATTATAT CACACAAACA	5780
TAACGGAAAT ATTTACTACT TCAACAGTTG ACCAATA TGA TATTTATGAC CTATT ATTCA	5840
CTGAGTCAAT CAAGATGAGA GTGATAGATG TTGATTGAG TGATTACTCA ATTAC TCTTC	5900
AAGTTAGACT TCCTTTATTA ACTAAACTAT CAAATAC TCA AATT TATAAA GTAGATTCTA	5960
TATCATAACAA CATCCAGGGC AAAGAGTGGT ATATCCTCT TCCCAATCAC ATCATG CAA	6020
AAGGGGCTTT TCTAGGTGGT GCTGATATTAA AAGAATG CAT AGAGGCATTC AGCAG TTATA	6080
TATGTCCTTC TGATCCAGGT TACATATTAA ATCACGA GAT AGAGAATTGT TTATC AGGGA	6140
ACATAACACA GTGTCTTAAG ACTGTTGTTA CATCAGATGT GGTACACGA TACG CGTTG	6200
TGAATGGTGG ATTAATTGCA AACTGCATAA CAACTACATG TACATGCAAT GGAAT TGACA	6260
ATAGAATTAA TCAATCACCT GATCAAGGAA TTAAGAT CAT AACACATAAA GAATGCCAGG	6320
TAATAGGTAT AAACGGAATG TTATTCAATA CTAATAGAGA AGGGACATTA GCAAC TTATA	6380
CATTTGATGA CATCATATTAA AATAACTCTG TTGCACTTAA TCCAATTGAT ATATCTAT GG	6440
AACTCAACAA GGCAAAACTA GAATTAGAAG AATCGAAGGA ATGGATAAAG AAATCAAATC	6500
AAAAGTTAGA TTCCGTTGGA AGTTGGTATC AATCTAGTGC AACAAATCACC ATAAT CATAG	6560
TGATGATAAT AATTCTAGTT ATAATCAATA TAACAAT TAT TGATGTCATA ATCAAATTCC	6620
ATAGAATTCA GGGGAAAGAT CAAAAGCACA AAAACAGTGA GCCGTATATA CTGACAAATA	6680
GACAATAAGA CTATACACGA TCAAATATAA AAAGTACAAA AACTTAGGA ACAAAAGTTGT	6740
TCAACACAGC AGCACCGAAT AGACCAAAAG GCAGCGCAGA GGCGACACCA AACTCAAAAA	6800
TGGAATATTG GAAACACACA AACAGCATAA ATAACACCAA CAATGAAACC GAAACAGCCA	6860
GAGGCAAACAA TAGTAGCAAG GTTACAAATA TCATAAT GTA CACCTTCTGG ACAAT AACAT	6920
TAACAATATT ATCAGTCATT TTTATAATGA TATTGACAAA CTTAATTCAA GAGAA CAATC	6980
ATAATAAATT AATGTTGCAG GAAATAAGAA AAGAATT CGC GGCAATAGAC ACCAAG ATTC	7040
AGAGGACTTC	7050

FIGURE 2C



Docket No.: NIH-0127
 Inventor: Mario H. Skiadopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAINFLUENZA VIRUS (PIV)
 VACCINES Page 11 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 36

GGATGACATT GGAACCTCAA TACAGTCAGG AATAAAATACA AGACTTCTCA CAATT CAGAG	7110
TCATGTTCAA AACTATATCC CACTATCATT AACACAAACAA ATGTCAGATC TCAGAAAATT	7170
TATCAATGAT CTAACAAATA AAAGAGAACAA TCAAGAAGTG CCAATACAGA GAATGACTCA	7230
TGATAGAGGT ATAGAACCCC TAAATCCAAA CAAGTTCTGG AGGTGTACAT CTGGTAACCC	7290
ATCTCTAACAA AGTAGTCCTA AGATAAGGTT AATACCAGGA CCAGGTTTAT TAGCAACATC	7350
TACTACAGTA AATGGCTGTA TTAGAATTCC ATCGTTAGTA ATCAATCATIC TAATCTATGC	7410
TTACACCTCT AATCTTATTA CCCAGGGCTG TCAAGATATA GGGAAATCTT ACCAAGTACT	7470
ACAAATAGGG ATAATTACTA TAAATTCGGA CCTAGTACCT GAT TTAAACC CCAGAGTCAC	7530
ACATACATTT AATATTGATG ATAATAGAAG ATCTTGCTCT CTGGCACTAT TGAATACAGA	7590
TGTTTATCAG TTATGCTCAA CACCAAAAGT TGATGAAAGA TCCGATTATG CATCAACAGG	7650
TATTGAGGAT ATTGTACTTG ACATTGTCAC TAATAATGGA TTAATTATAA CAACAAGGTT	7710
TACAAATAAT AATATAACTT TTGATAAAACC GTATGCAGCA TTGTATCCAT CAGTGGGACC	7770
AGGAATCTAT TATAAGGATA AAGTTATATT TCTCGGA TAT GGAGGTCTAG AGCATGAAGA	7830
AAACGGAGAC GTAATATGTA ATACAACCTGG TTGTCCTGGC AAAACACAGA GAGACTGTAA	7890
TCAGGCTTCT TATAGCCCAT GGTCTCAA TAGGAGAATG GTAAACTCTA TTATTGTTGT	7950
TGATAAAGGC ATAGATGCAA CTTTTAGCTT GAGGGTGTGG ACTATTCCAA TGAGCCAAAA	8010
TTATTGGGGA TCAGAAGGAA GATTACTTTT ATTAGGTGAC AGAATATACA TATATACTAG	8070
ATCCACAAGT TGGCACAGTA AATTACAGTT AGGGTAATT GATATTCTG ATTATACTAA	8130
TATAAGAATA AATTGGACTT GGCATAATGT ACTATCACGG CCAGGGAATG ATGAATGTCC	8190
ATGGGGTCAT TCATGCCAG ACGGATGTAT AACAGGAGTT TACACTGATG CATATCCGCT	8250
AAACCCATCG GGGAGTGTG TATCATCAGT AATTCTTGTAT TCACAAAAGT CTAGAGAAAA	8310
CCCAATCATT ACTTACTCAA CAGCTACAAA TAGAATAAT GAATTAGCTA TATATAACAG	8370
AACACTTCCA GCTGCATATA CAACAACAAA TTGTATCACA CATTATGATA AAGGGTATTG	8430
TTTCATATA GTAGAAATAA ATCACAGAAG TTTGAATACG TTTCAACCTA TGTTATCAA	8490
AACAGAAGTT CCAAAAACAT GCAGCTAAAT TGATCATCGC ATATCGGATG CAAGATGACA	8550
TTAAAAGAGA CCACCAAGACA GACAACACAG GAGACGATGC AAGATATAAA GAAATAATAA	8610
AAAACCTAGG AGAAAAGTGT GCAAGAAAAA TGGACACCGA GTCCCACAGC GGCACAACAT	8670
CTGACATTCT GTACCTGAA TGTCACCTCA ATTCTCTAT AGTTAAAGGA AAGATAGCAC	8730
AACTGCATAC AATAATGAGT TTGCCTCAGC CCTACGATAT GGATGATGAT TCAATACTGA	8790
TTATTACTAG ACAAAAAATT AACTCAATA AATTAGATAA AAGACAACGG TCAATTAGGA	8850
AATTAAGATC AGTCTTAATG GAAAGAGTAA GTGATCTAGG TAAATATACC TTTATCAGAT	8910
ATCCAGAGAT GTCTAGTGAAT ATGTTCCAAT TATGTATACC CGGAATTAAT AATAAAATAA	8970
ATGAATTGCT AAGTAAAGCA AGTAAAACAT ATAATCAAAT GACTGATGGA TTAAGAGATC	9030
TATGGGTTAC TATACTATCG AAGTTAGCAT CGAAAAATGA TGGAAGTAAT TATGATATCA	9090
ATGAAGATAT TAGCAATATA TCAAATGTT ACATGACTTA TCAATCAGAC AAATGGTATA	9150
ATCCATTCAA GACATGGTT ACTATTAAGT ATGACATGAG AAGATTACAA AAAGCCAAAA	9210
ATGAGATTAC ATTCAATAGG CATAAAAGATT ATAATCTATT AGAAGACCAA AAGAAATATAT	9270
TGCTGATACA TCCAGAACTC GTCTTAATAT TAGATAACAA AAATTACAAT GGGTATATAA	9330
TGACTCCTGA ATTGGTACTA ATGTATTGTG ATGTAGTTGA AGGGAGGTGG AATATAAGTT	9390
CATGTGCAAA	9400

FIGURE 2D



SEQ ID NO: 36

ATTGGATCCT AAGTTACAAT CAATGTATTA TAAGGGTAAAC AATTTATGGG AAATAATAGA	9460
TGGACTATTC TCGACCTTAG GAGAAAGAAC ATTTGACATA ATATCACTAT TAGAACCCT	9520
TGCATTATCG CTCATTCAAA CTTATGACCC GGTAAACAG CTCAGGGGGG CTTTTTAA	9580
TCACGTGTTA TCAGAAATGG AATTAATATT TGCACTTGAG TGTACAACAG AGGAAATACC	9640
TAATGTGGAT TATATAGATA AAATTTAGA TGTGTTAAA GAATCAACAA TAGATGAAAT	9700
AGCAGAAATT TTCTCTTCT TCCGAACCTT TGGACACCCCT CCATTAGAGG CGAGTATAGC	9760
AGCAGAGAAA GTTAGAAAGT ATATGTATAC TGAGAAATGC TTGAAATTG ATACTATCAA	9820
TAAATGTCAT GCTATTTTT GTACAATAAT TATAATGGA TATAGAGAAA GACATGGTGG	9880
TCAATGGCCT CCAGTTACAT TACCTGTCCA TGACATGAA TTTATCATAA ATGCA TACGG	9940
ATCAAATTCT GCCATATCAT ATGAGAATGC TGTAGAT TAT TATAAGAGCT TCATAGGAAT	10000
AAAATTGAC AAGTTTATAG AGCCTCAATT GGATGAAGAC TTAACTATTT ATATGAAAGA	10060
TAAAGCATTAA TCCCCAAAGA AATCAAACGT GGACACAGTC TATCCAGCTT CAAACCTGTT	10120
ATACCGCACT AATGTGTCTC ATGATTCAAG AAGATTGGTT GAAGTATTAA TAGCAGATAG	10180
TAAATTTGAT CCCCACCAAG TATTAGATTA CGTAGAAATCA GGATATTGGC TGGATGATCC	10240
TGAATTTAAT ATCTCATATA GTTTAAAAGA GAAAGAAATA AAAC AAGAAG GTAGACTTTT	10300
TGCAAAATG ACATACAAGA TGAGGGCTAC ACAAGTATTA TCAGAAACAT TATTGGCAA	10360
TAATATAGGG AAATTCTTCC AAGAGAATGG GATGGTTAAA GGAGAAATTG AATTACTCAA	10420
GAGACTAAC ACAAATATCTA TGTCTGGAGT TCCGGCGTAT AATGAGGTAT ACAATAATT	10480
AAAAAGTCAC ACAGAAGAAC TTCAAGCTTA TAATGCAATT AGCAGTTCCA ATTTATCTTC	10540
TAATCAGAAG TCAAAGAAGT TTGAATTAA ATCTACAGAT ATATACAATG ATGGA TACGA	10600
AACCGTAAGC TGCTCTTAA CGACAGATCT TAAAAAAATAT TGTTAAATT GGAGGTATGA	10660
ATCAACAGCT TTATCGGTG ATACTTG TAA TCAGATATTT GGGTTAAAGG AATTATTTAA	10720
TTGGCTGCAC CCTCGCCTTG AAAAGAGTAC AATATATGTT GGAGATCCTT ATTGCCGCC	10780
ATCAGATATT GAACATTTAC CACTTGATGA CCATCCTGAT TCAGGATTTT ATGTT CATAA	10840
TCCTAAAGGA GGAATAGAAC GGTTTGCCA AAAGTTATGG ACACTCATAT CTATCAGTGC	10900
AATACATTTA GCAGCTGTCA AAATCGGTGT AAGAGTTACT GCAATGGTTC AAGGGATAA	10960
TCAAGCCATA GCTGTTACCA CAAGAGTACC TAATAATTAT GATTATAAAAG TTAAGAAAGA	11020
GATTGTTAT AAAGATGTGG TAAGATTTTG TGATTCC TTG AGAGAGGTGA TGGATGATCT	11080
GGGTCATGAG CTCAAACTAA ATGAAACTAT AATAAGTAGT AAAATGTTA TATATAGCAA	11140
AAGGATATAC TATGACGGAA GAATCCTTCC TCAGGCATTA AAAGCATTGT CTAGATGTGT	11200
TTTTGGTCT GAAACAATCA TAGATGAGAC AAGATCAGCA TCCTCAAATC TGGCTACATC	11260
GTTTGCAAAG GCCATTGAGA ATGGCTACTC ACCTGTATTG GGATATGTAT GCTCAATCTT	11320
AAAAATATC CAACAGTTGT ATATAGCGCT TGGAAATGAAT ATAAACCCAA CTATAACCCA	11380
AAATATTAAA GATCAATAT T TCAGGAATAT TCATTGGATG CAATATGCCT CCTTAATCCC	11440
TGCTAGTGTC GGAGGATTAA ATTATATGGC CATGTCAAGG TGTTTGTC GAAACATTGG	11500
AGATCCTACA GTCGCTGCGT TAGCCGATAT TAAAAGATTT ATAAAAGCAA ATTTGTTAGA	11560
TCGAGGTGTC CTTTACAGAA TTATGAATCA AGAACCAAGGC GAGTCTTCTT TTTAGACTG	11620
GGCCTCAGAT CCCTATTACAT GTAACCTTACCA ACAATCTCAA AATATAACCCA CCATGATAAA	11680
GAATATAACT GCAAGAAATG TACTACAGGA CTCACCAAAAC CCATTACTAT CTGGATTATT	11740
TACAAGTACA	11750

FIGURE 2E

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 Inventor: Mario H. Skiadopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAINFLUENZA VIRUS (PIV)
 VACCINES Page 13 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001



SEQ ID NO: 36

ATGATAGAAG AGGATGAGGA ATTAGCTGAG TTCTAA TGG ACAGGAGAAT AATCC TCCC	11850
AGAGTTGCAC ATGACATT T AGATAATTCT CTTACTGGAA TTAGGAATGC TATAG CTGGT	11870
ATGTTGGATA CAACAAAATC ACTAATTCGA GTAGGGATAA GCAGAGGAGG ATTAACCTAT	11930
AACTTATTAA GAAAGATAAG CAACTATGAT CTTGTACAAT ATGAGACACT TAGTAAA ACT	11990
TTAAGACTAA TAGTCAGTGA CAAGATTAAG TATGAAGATA TGTGCTCAGT AGACC TAGCC	12050
ATATCATTAA GACAAAAAAAT GTGGATGCAT TTATCAGGAG GAAGAATGAT AAATGGACTT	12110
GAAACTCCAG ATCCTTAGA GTTACTGTCT GGAGTAA TAA TAACAGGATC TGAAC ATTGT	12170
AGGATATGTT ATTCAACTGA AGGTGAAAGC CCATATA CAT GGATGTATTT ACCAG GCAAT	12230
CTTAATATAG GATCAGCTGA GACAGGAATA GCATCAT TAA GGGTCCCTTA CTTTGATCA	12290
GTTACAGATG AGAGATCTGA AGCACAA TAA GGGTATA TCA AAAATCTAAG CAAAC CAGCT	12350
AAGGCTGCTA TAAGAATAGC AATGATATAT ACTT GGGCAT TTGGGAATGA CGAAATATCT	12410
TGGATGGAAG CATCACAGAT TGCA CAAACACA CGTGCAA ACT TTACATTGGA TAGCT TAAAG	12470
ATTTGACAC CAGTGACAC ATCAACAAAT CTATCACACA GGTTAAAAGA TACTGCTACT	12530
CAGATGAAAT TTTCTAGTAC ATCACTTATT AGAGTAAGCA GGTTCATCAC AATATCTAAT	12590
GATAATATGT CTATTAAGA AGCAAATGAA ACTAAAGATA CAAATCTTAT TTATCAACAG	12650
GTAATGTTAA CAGGATTAAG TGATTTGAA TATCTATT TAA GGTTAGAGGA GAGTACAGGA	12710
CATAACCCCTA TGGTCATGCA TCTACATATA GAGGATGGAT GTTGTATAAA AGAGAGTTAC	12770
AATGATGAGC ATATCAATCC GGAGTCTACA TTAGAGTTAA TCAAATACCC TGA GAGTAAT	12830
GAATTTATAT ATGATAAGGA CCCTTAAAG GATATAGATC TATCAAATT AATGG TTATA	12890
AGAGATCATT CTTATACAAAT TGACATGAAT TACTGGGATG ACACAGATAT TGTACATGCA	12950
ATATCAATAT GTACTGCAGT TACAATAGCA GATACAATGT CGCAGCTAGA TCGGGATAAT	13010
CTTAAGGAGC TGGTTGTGAT TGCAAAATGAT GATGATATT A ACAGTCTGAT AACTGAA TTT	13070
CTGACCCCTAG ATATACTAGT GTTTCTCAAACATTTGGAG GGTTACTCGT GAATCAATT	13130
GCATATAACCC TTTATGGATT GAAAATAGAA GGAAGGGATC CCATTGGGA TTATA TAAATG	13190
AGAACATTAA AAGACACCTC ACATTCAGTA CTTAAAGTAT TATCTATGC ACTATCTCAT	13250
CCAAAAGTGT TTAAGAGATT TTGGGATTGT GGAGTT TGA ATCCTATT TAA GGTC CTAAT	13310
ACTGCTAGTC AAGATCAAGT TAAGCTTGCT CTCTCGA TTT GCGAGTACTC CTTGGATCTA	13370
TTTATGAGAG AATGGGTGAA TGGAGCATCA CTTGAGATCT ATATCTGTGA TAGTGACATG	13430
GAAAATAGCAA ATGACAGAAG ACAAGCATT CTCTCAAGAC ATCTGCCCT TGTGTGTTGT	13490
TTAGCAGAGA TAGCATCTT TGGACCAAAT TTATTAATC TAACATATCT AGAGAGACTT	13550
GATGAATTAA AACAACTACTT AGATCTGAAC ATCAAAGAAG ATCCTACTCT TAAATATGTG	13610
CAAGTATCAG GACTGTTAAT TAAATCATT C C C T C A A C T G TTACGTATGT AAGGAAA ACT	13670
GGGATTAAGT ATCTGAGGAT TCGTGGTATT AATCCGCCTG AAACGATTGA AGATTGGGAT	13730
CCCATAGAAG ATGAGAATAT CTTAGACAAT ATTGTTAAA CTGTAATGA CAATTGCAGT	13790
GATAATCAAAG AGAGAAAATAA AAGTAGTTAT TTCTGGGAT TAGCTCTAAA GAATTATCAA	13850
GTCGTGAAAA TAAGATCCAT AACGAGTGAT TCTGAAGTTA ATGAAGCTTC GAATGTTACT	13910
ACACATGGAA TGACACTTCC TCAGGGAGGA AGTTATC TAT CACATCAGCT GAGGT TATT	13970
GGAGTAAACA GTACAAGTTG TCTTAAAGCT CTTGAATT TAT CACAAATCTT AATGAGGGAA	14030
GTAAAAAAAG ATAAAGATAG ACTCTTTTA GGAGAAGGAG CAGGAGCTAT GTTAGCATGT	14090
TATGATGCTA	14100

FIGURE 2F

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SEQ ID NO: 36

CACTCGGTCC TGCAATAAAAT TATTATAATT CTGGTTAAA TATTACAGAT GTAAT TGGTC	14160
AACGGGAATT AAAAATCTTC CCATCAGAAG TATCATTAGT AGGTAAAAAA CTAGGAAATG	14220
TAACACAGAT TCTTAATCGG GTGAGGGTGT TATTTAATGG GAATCCCAAT TCAACATGGA	14280
TAGGAAATAT GGAATGTGAG AGTTTAATAT GGAGTGAATT AAATGATAAG TCAATTGGTT	14340
TAGTACATTG TGACATGGAG GGAGCGATAG GCAAATCAGA AGAAACTGTT CTACATGAAC	14400
ATTATAGTAT TATTAGGATT ACATATTTAA TCGGGGATGA TGATGTTGTC CTAGTATCAA	14460
AAATTATACC AACTATTACT CCGAATTGGT CTAAAATACT CTATCTATAC AAGTTGTATT	14520
GGAAGGATGT AAGTGTAGTG TCCCTTAAAA CATCCAATCC TGCCTCAACA GAGCT TTATT	14580
TAATTCAAA AGATGCTTAC TGTACTGTAA TGGAACCAG TAATCTTGTG TTATCAAAAC	14640
TTAAAAGGAT ATCATCAATA GAAGAAAATA ATCTTAAATTA GTGGATAATC TTATCAAAA	14700
GGAAGAATAA CGAGTGGTTA CAGCATGAAA TCAAAGAAGG AGAAAGGGAT TATGGGATAA	14760
TGAGGCCATA TCATACAGCA CTGCAAATT TTGGATTCCA AATTAACCTTA AATCACTTAG	14820
CTAGAGAATT TTTATCAACT CCTGATTAA CCAACATTAA TAATATAATT CAAAGTTTTA	14880
CAAGAACAAAT TAAAGATGTT ATGTTGAAAT GGGTCAAAT CACTCATGAC AATAAAAGAC	14940
ATAAAATTAGG AGGAAGATAT AATCTATTCC CGCTTAAAAA TAAGGGAAA TTAAGATTAT	15000
TATCACGAAAG ATTAGTACTA AGCTGGATAT CATTATCCTT ATCAACCAGA TTACTGACGG	15060
GCCGTTTCC AGATGAAAAA TTTGAAAATA GGGCACAGAC CGGATATGTA TCATTGGCTG	15120
ATATTGATT AGAACCTTA AAGTTATTAT CAAGAAATA TGTCAAAAT TACAAAGAAC	15180
ACATAGGATT AATATCATAAC TGGTTTTGA CCAAAGAGGT CAAAATACTA ATGAAGCTTA	15240
TAGGAGGAGT CAAACTACTA GGAATTCTTA AACAGTACAA AGAGTTAGAG GATCGATCAT	15300
CTCAGGGTTA TGAATATGAT AATGAATTG ATATTGATTA ATACATAAAA ACATAAAATA	15360
AAACACCTAT TCCTCACCCA TTCACTTCCA ACAAAATGAA AAGTAAGAAA AACATGTAAT	15420
ATATATATAC CAAACAGAGT TTTCTCTTG TTTGGT	15456

FIGURE 2G

FIG. 3A

Mutagenesis to create restriction sites at start and stop codons of N

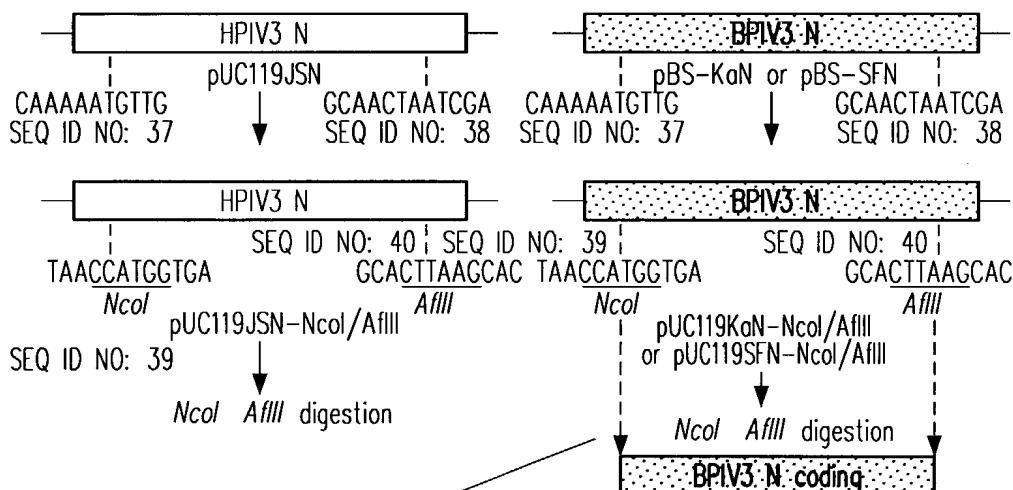


FIG. 3B

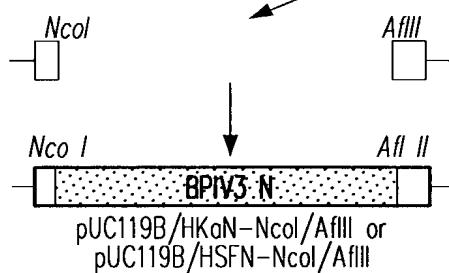
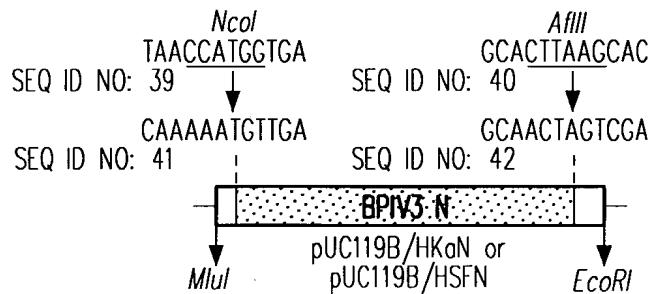


FIG. 3C

Mutagenesis to restore start and stop codon context



LEGEND

- [Stippled Box] BPIV3 sequence
- [White Box] HPIV3 sequence



FIG. 4A

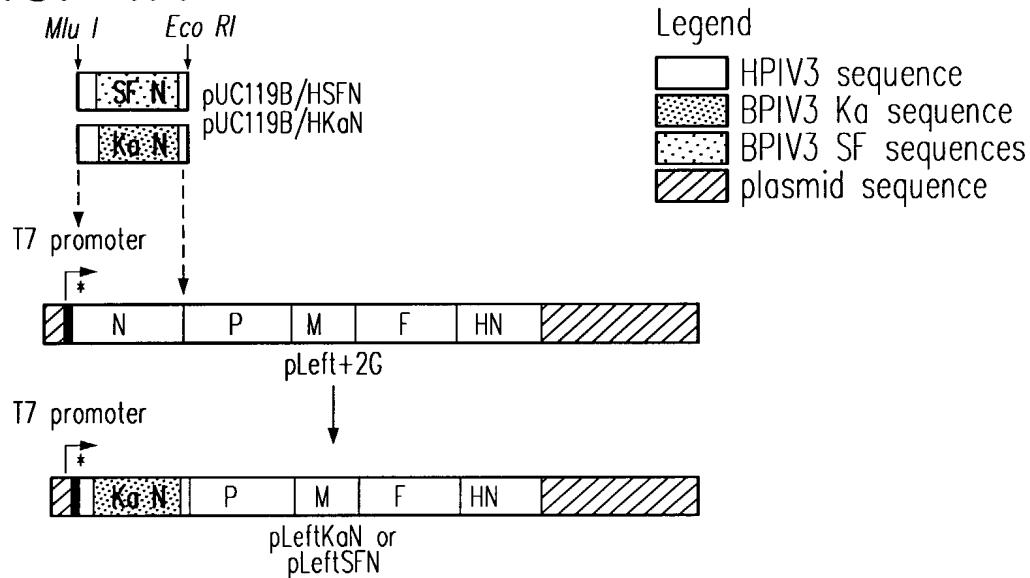
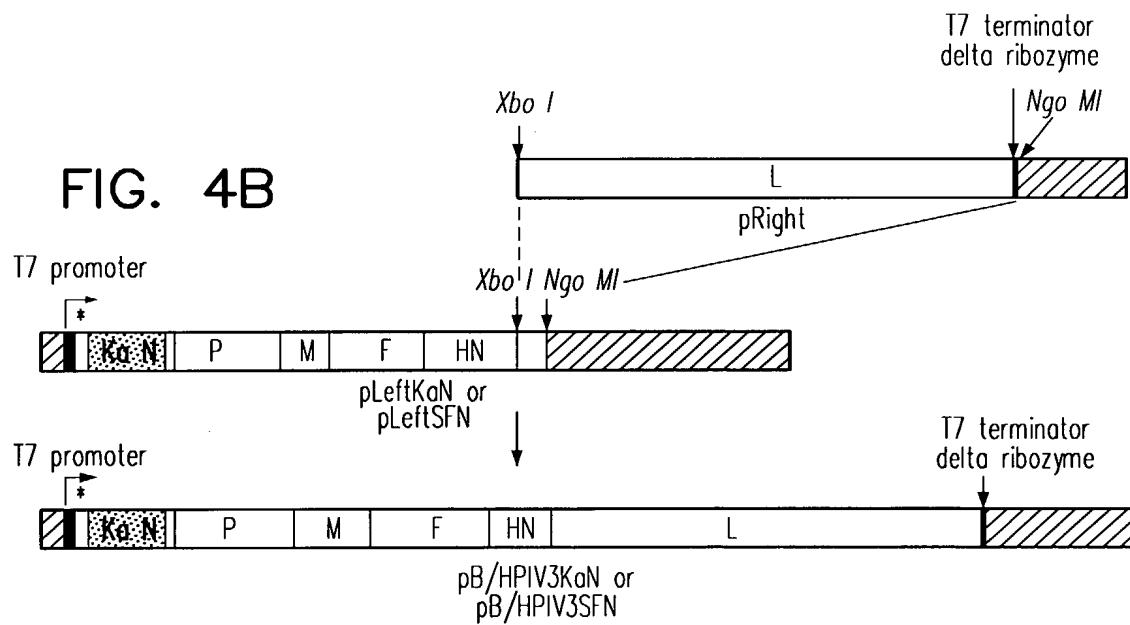


FIG. 4B





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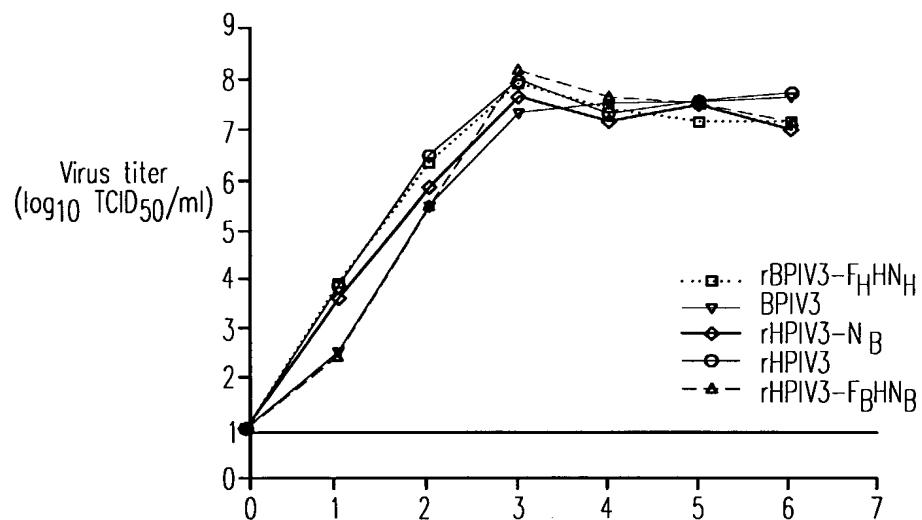
FIG. 5A

SEQ ID NO: 43	rJS	GGAAC TCTATAATTCAAAA <u>A</u> GTTGACCTATTCGATAC
SEQ ID NO: 44	cKa	GGAAC TCTATAATTCAAAA <u>A</u> GTTGACTCTATTCGACAC
SEQ ID NO: 45	cSF	GGAAC TCTATAATTCAAAA <u>A</u> GTTGAGTCTATTCGACAC
SEQ ID NO: 46	Ka	GAAAT CCTAAGACTGTAA <u>T</u> CATGTTGAGTCTATTCGACAC
SEQ ID NO: 47	SF	GAAAT CCTAAGACTGTAA <u>T</u> CATGTTGAGTCTATTCGACAC

FIG. 5B

SEQ ID NO: 48	rJS	TTAACGCATTGGAAGCAACT <u>A</u> ATCGAATCAACATTTAA
SEQ ID NO: 49	cKa	TCAGTGCATTCCGAAGCAACT <u>A</u> GTCAATCAACATTTAA
SEQ ID NO: 50	cSF	TCAGTGCATTCCGAAGCAACT <u>A</u> GTCAATCAACATTTAA
SEQ ID NO: 51	Ka	TCAGTGCATTCCGAAGCAACT <u>A</u> GTCAAAAGAGATGACCA
SEQ ID NO: 52	SF	TCAGTGCATTCCGAAGCAACT <u>A</u> GTCAAAAGAGATGACCA

FIG. 13



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Confirmation of identity of potential BPIV3/HPIV3 chimeras by *TaqI* digestion

Figure 6A

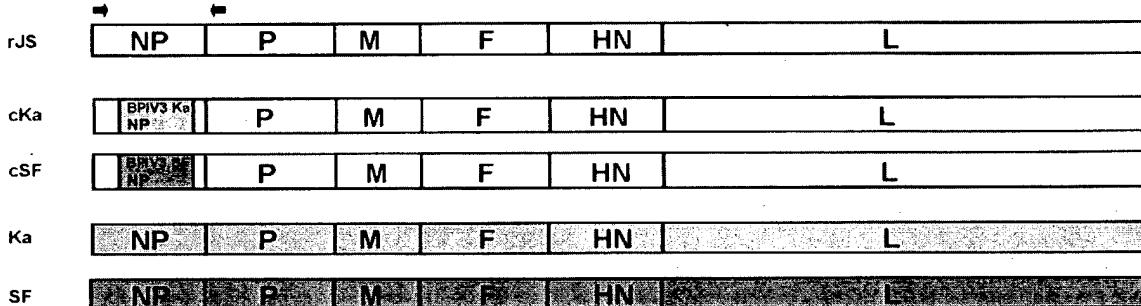


Figure 6B

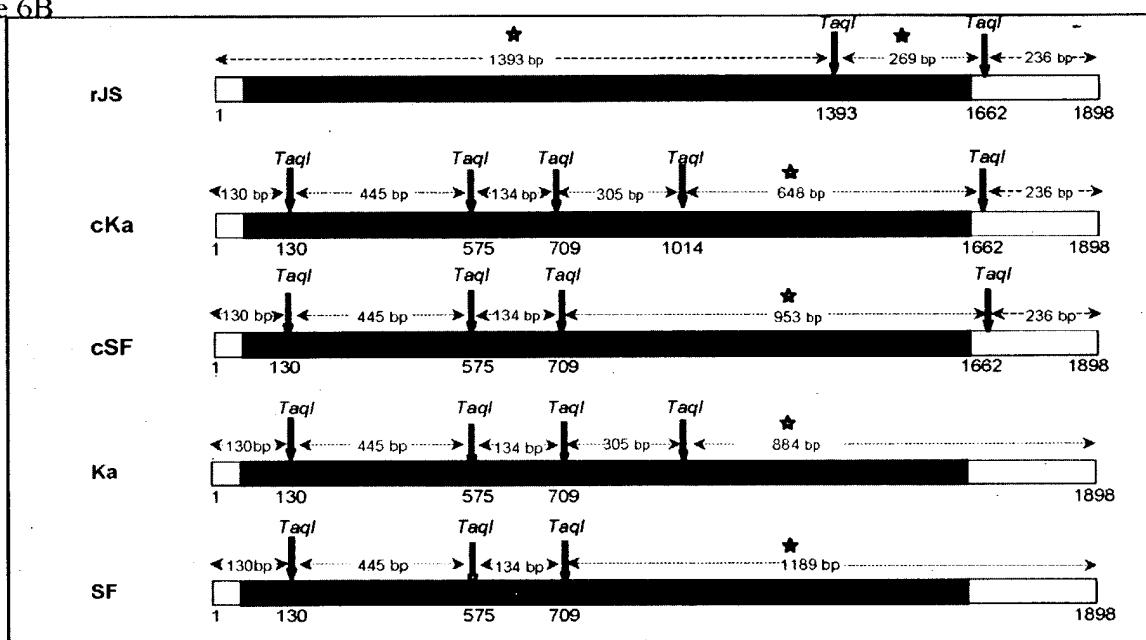
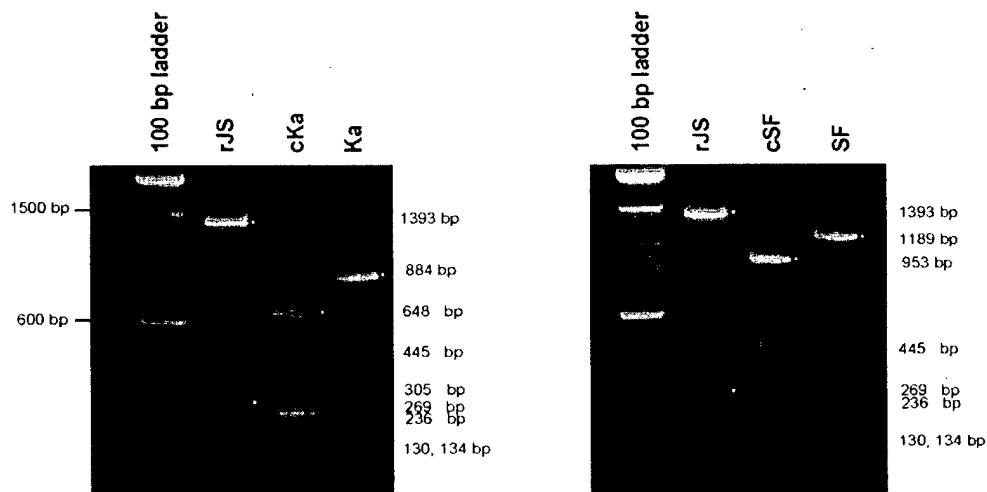


Figure 6C





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FIG. 7A

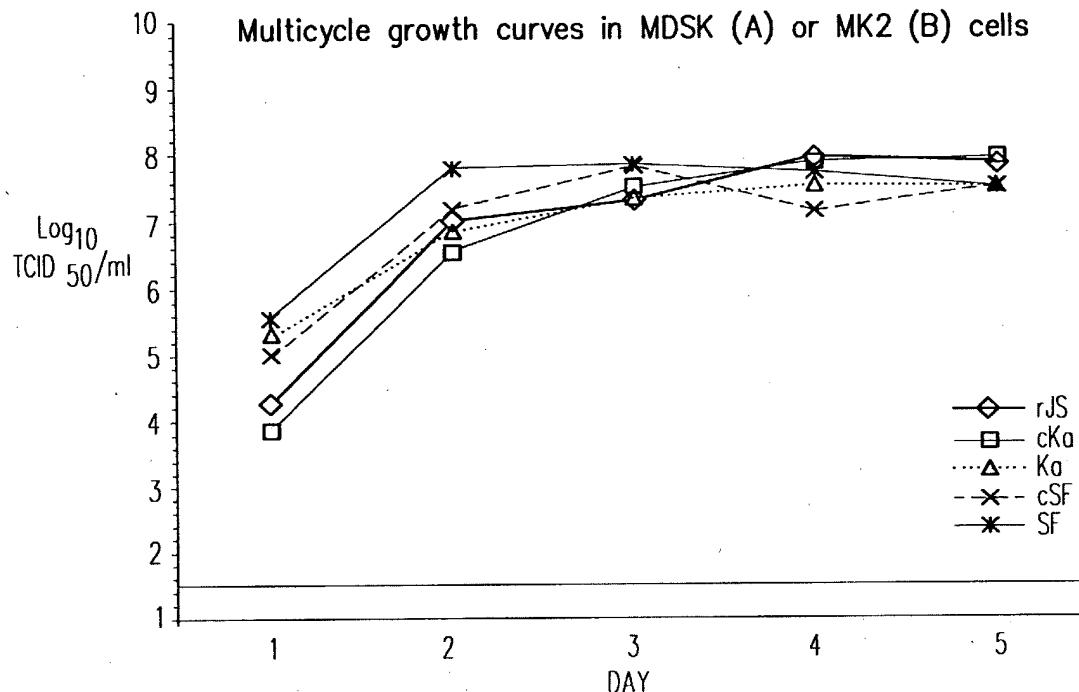
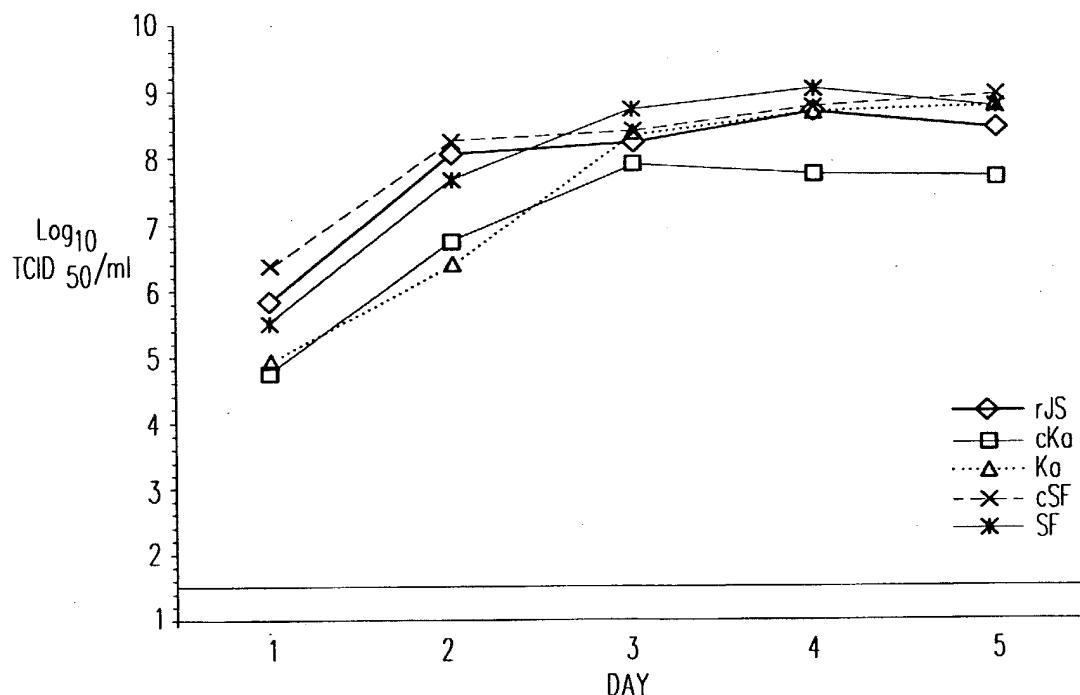


FIG. 7B





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FIG. 8A

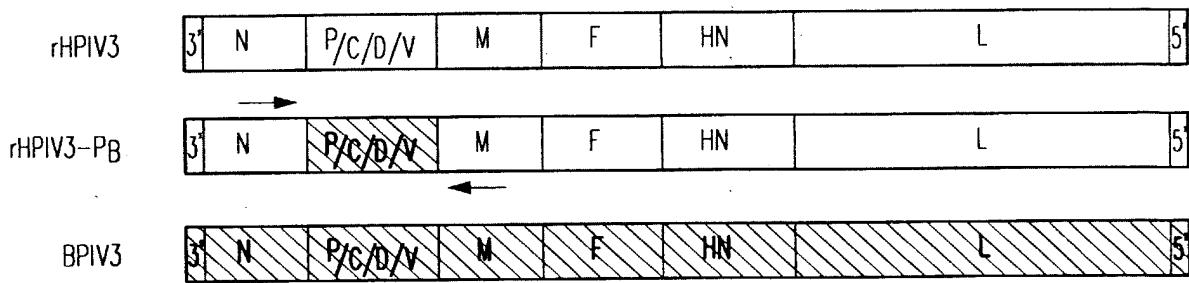


FIG. 8B

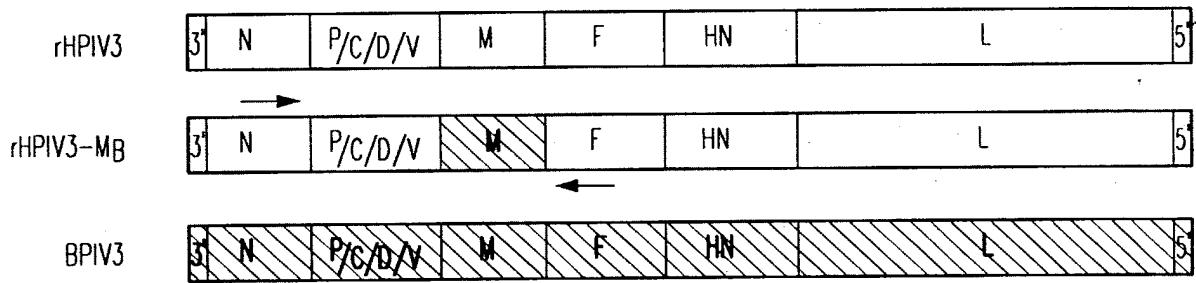
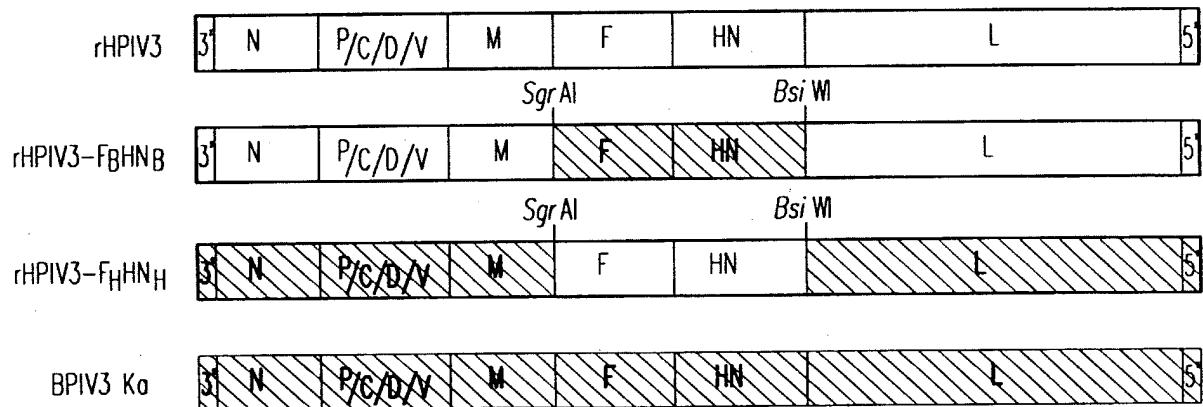


FIG. 11A



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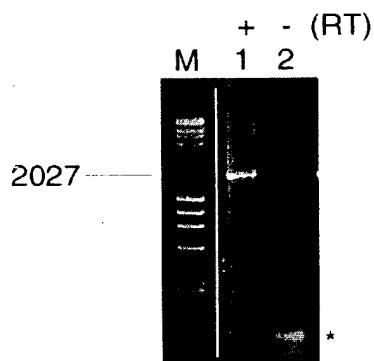
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Figure 9A



rHPIV3-PB

Figure 9B

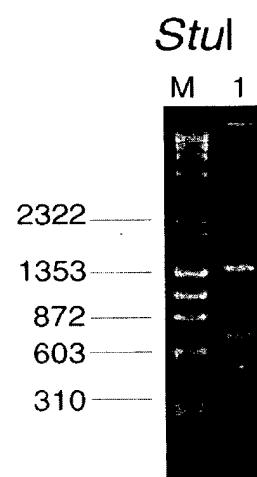
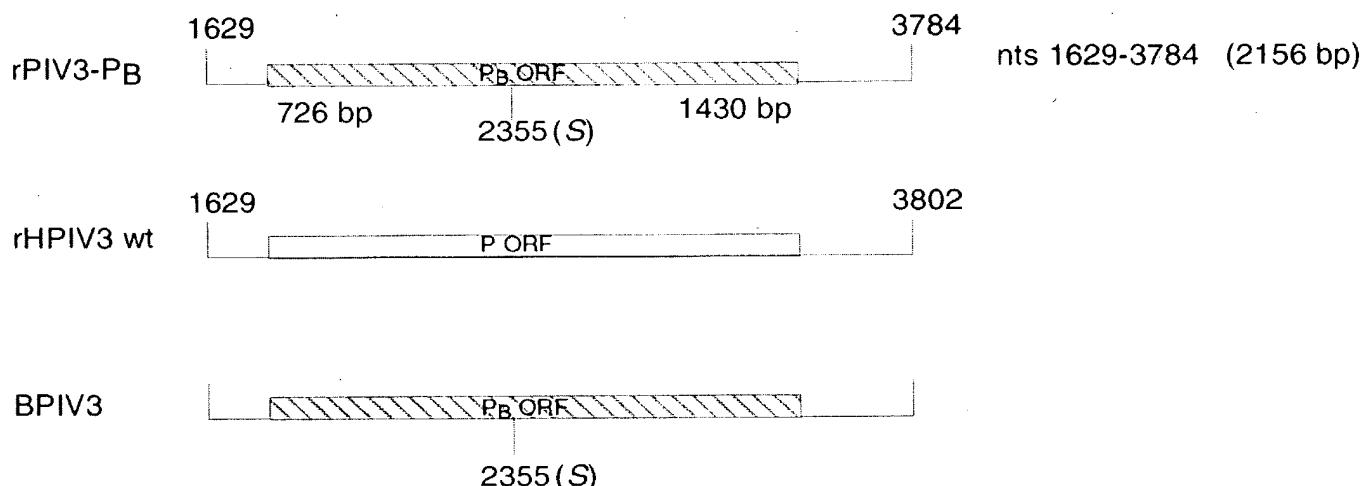


Figure 9C





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Figure 10A

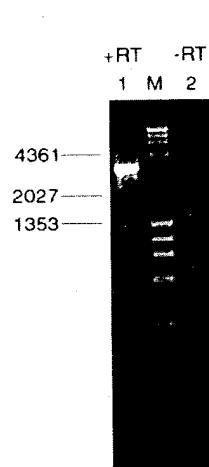


Figure 10C

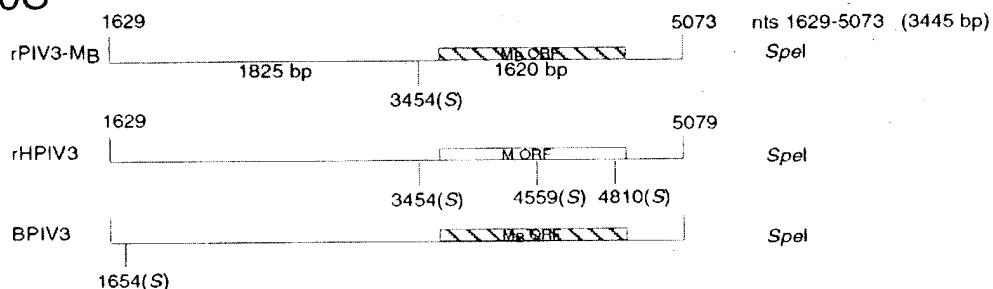
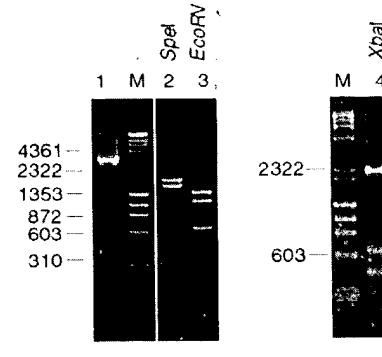
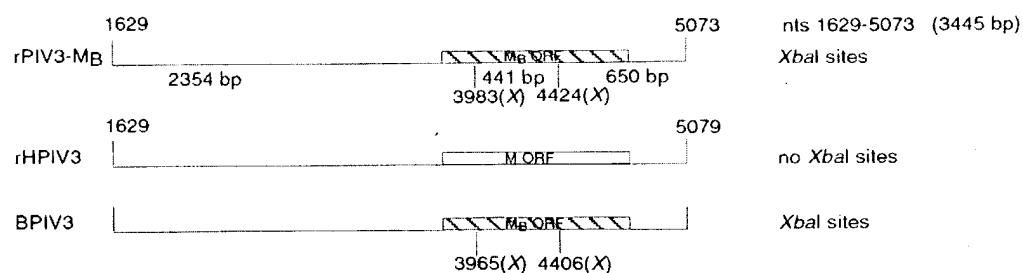
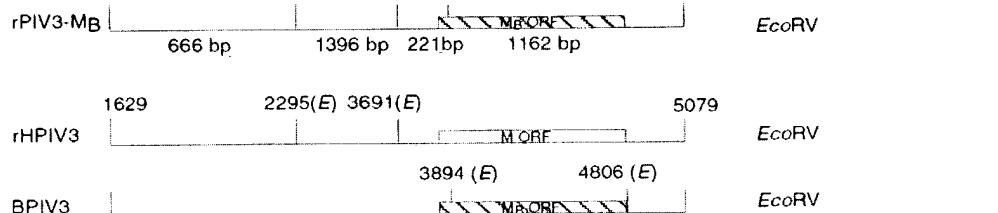
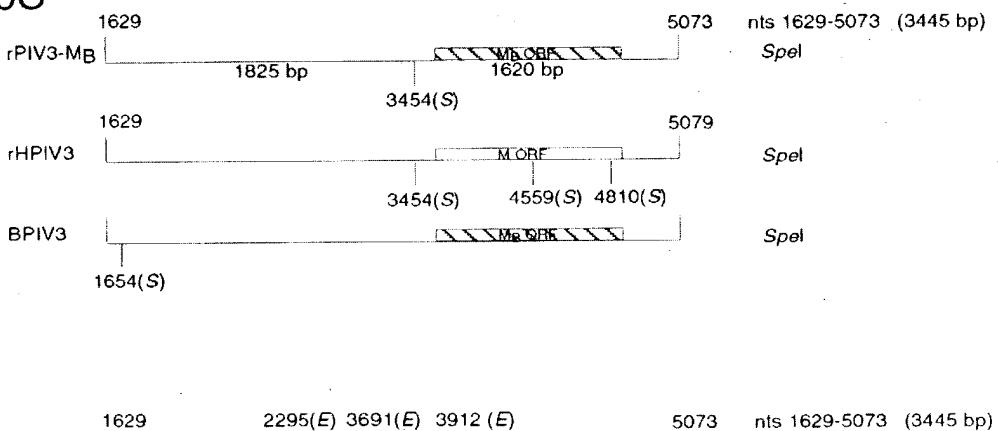


Figure10B



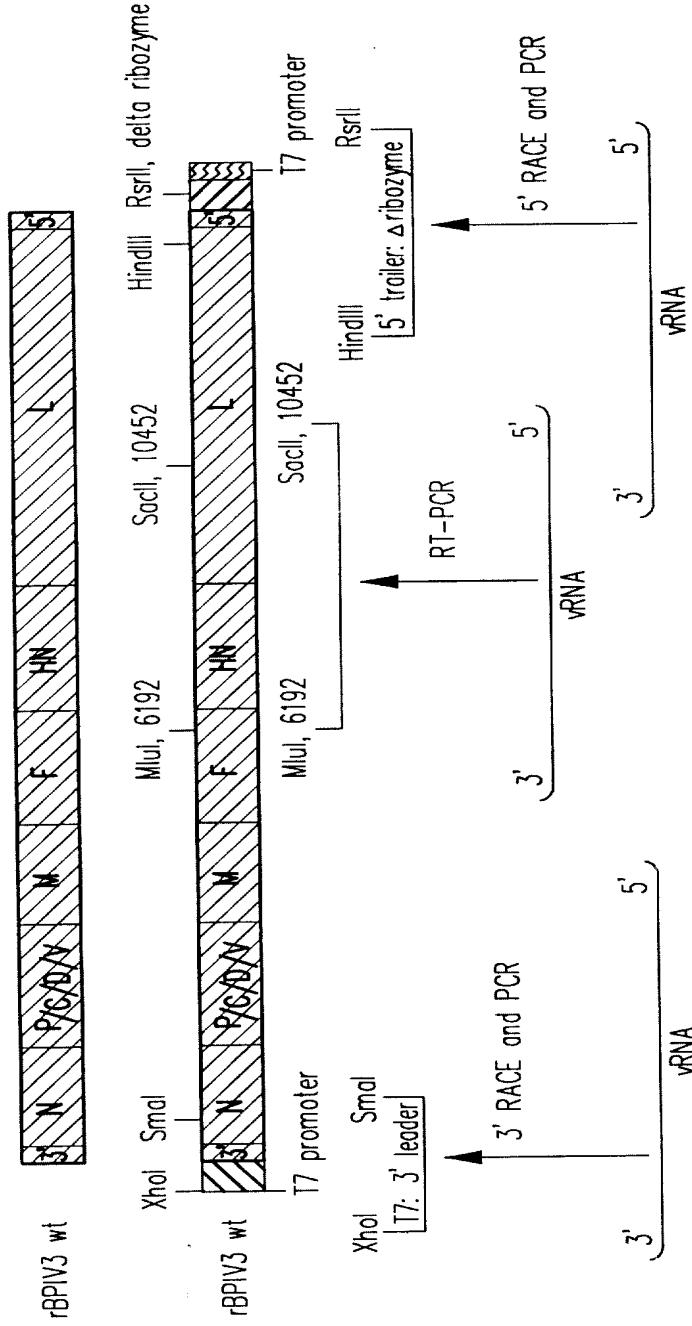
rHPIV3-MB



SCANNED #

FIG. 11B

Assembly of an antigenomic cDNA for BPIV3 Ka



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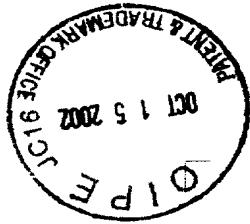




FIG. 11C

Generation of full length cDNA clones encoding rPIV3/rPIV3 antigenic chimeric viruses

Generation of rPIV3 and rPIV3 full length clones

rPIV3 JS	5'	N	P/C/D/V	M	F	HN		L	5'
		CGGACGTATCTA		TAGACAAAAGCC					
SEQ ID NO: 29				SEQ ID NO: 53					

4832 8597

Mutagenesis to create unique SgrAI and SmaI restriction sites

rPIV3s	5'	N	P/C/D/V	M	F	HN		L	5'
		CGCAC <u>CCGGTGTCA</u>		TAGAC <u>GTA</u> CGGG					
SEQ ID NO: 30				SEQ ID NO: 55					

4832 8597

3. Cloning of the F and HN genes into the heterologous full length cDNA

rPIV3 FBHNs	5'	N	P/C/D/V	M	F	HN		L	5'
		CGCAC <u>CCGGTGTCA</u>		AAGAC <u>GTA</u> CGGC					
SEQ ID NO: 57				SEQ ID NO: 58					

4832 8615

rPIV3 Ka	5'	N	P/C/D/V	M	F	HN		L	5'
		TCCAA <u>CATTGCA</u>		AAGATA <u>AAAGA</u>					
SEQ ID NO: 27				SEQ ID NO: 57					

4808 8591

rPIV3s	5'	N	P/C/D/V	M	F	HN		L	5'
		TCC <u>ACGGTGTCA</u>		AAGAC <u>GTA</u> CGGA					
SEQ ID NO: 28				SEQ ID NO: 56					

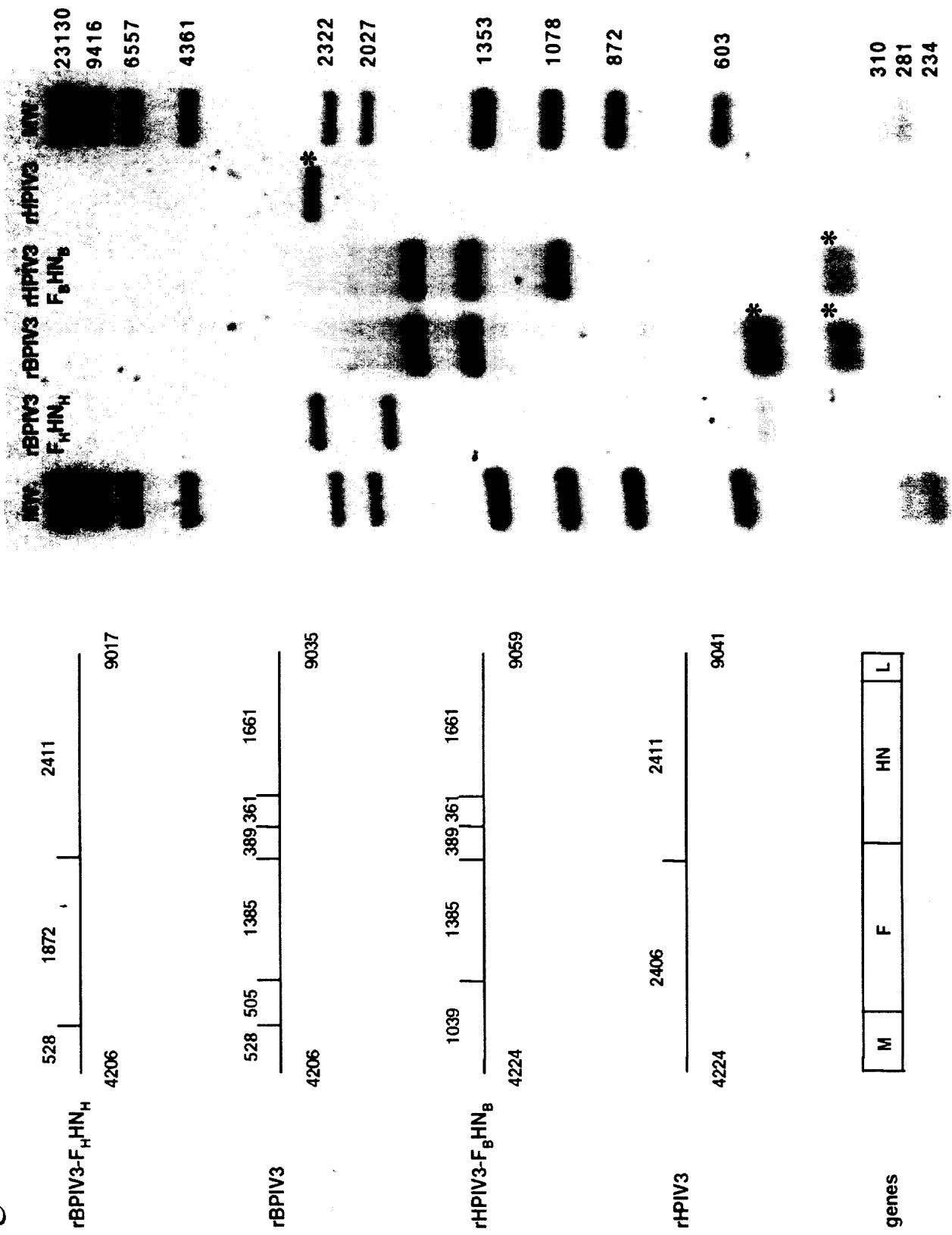
4808 8591

rPIV3 FHHNH	5'	N	P/C/D/V	M	F	HN		L	5'
		TCC <u>ACGGTGTCA</u>		AGAC <u>GTA</u> CGGA					
SEQ ID NO: 59				SEQ ID NO: 60					

4808 8973

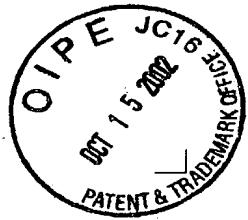
Figure 12

SCANNED, #



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 Docket No.: NIH-0127
 Inventor: Mario H. Skladopoulos et al.

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FIG. 14A

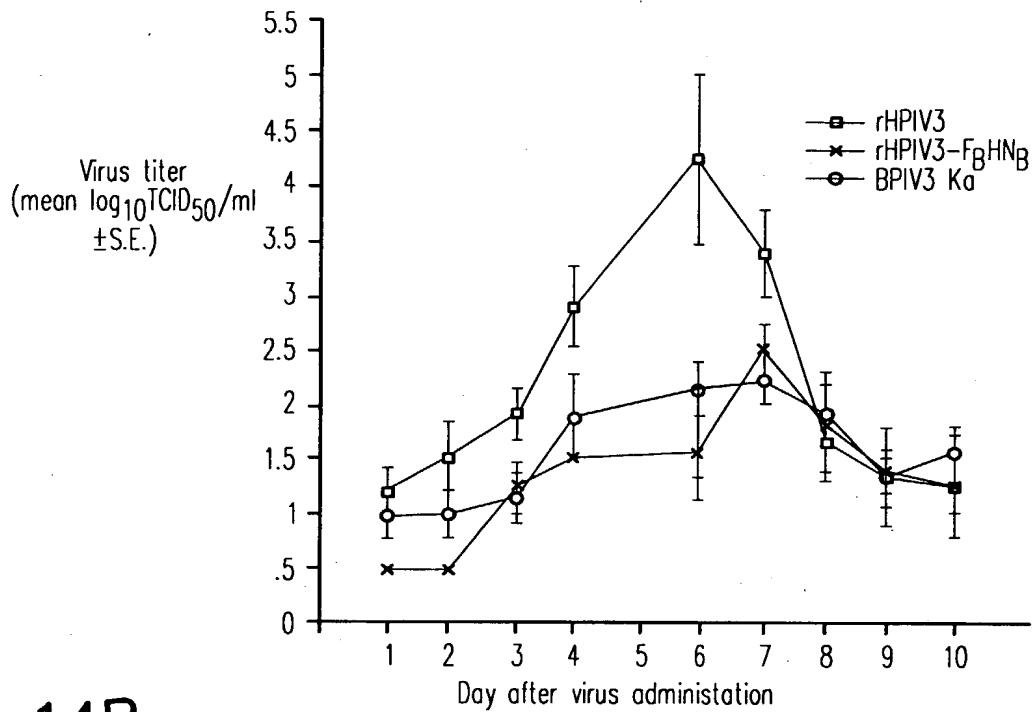
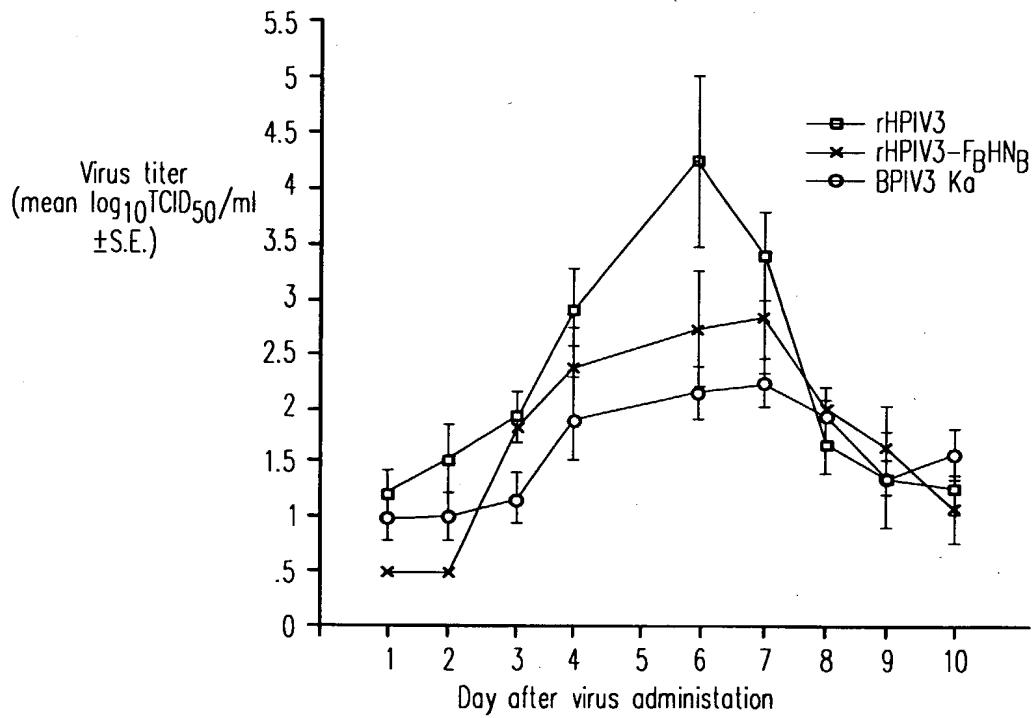


FIG. 14B



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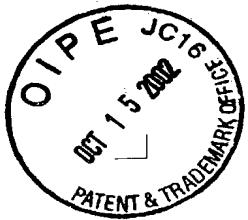


FIG. 15

rHPIV3	3'	N	P/C/D/V	M	F	HN	L	5'
rHPIV3 LB	3'	N	P/C/D/V	M	F	HN	LB	5'
rBPIV3 Kansas	3'	N	P/C/D/V	M	F	HN	LB	5'

FIG. 16

L START

SEQ ID NO: 61 rHPIV3 WT 8623 5' TAGGACCAAAGCGCTGCTCGGAAATGGACACTGAATCTAAC 3' 8664
 SEQ ID NO: 62 rHPIV3 LB 8623 5' TAGGACCAAAGCGCTGCTCGGAAATGGACACCCAGTCCCACA 3' 8664
 SEQ ID NO: 63 rBPIV3 wt 8617 5' TAGGAGAAAAGTGTGCAAGAAAAATGGACACCCAGTCCCACA 3' 8658

L STOP

SEQ ID NO: 64 rHPIV3 WT 15325 5' ATGATGAATTTCATATCGATTTACATAAATACAATGAACA 3' 15366
 SEQ ID NO: 65 rHPIV3 LB 15325 5' ATAATGAATTTCATATCGATTTACATAAATACGTACGTACAATGAAGA 3' 15366
 SEQ ID NO: 66 rBPIV3 wt 15319 5' ATAATGAATTTCATATCGATTTACATAAATACATAAAACATAAAATA 3' 15360